GEOTECHNICAL INVESTIGATION

CITY OF HOUSTON WATER LINE REPLACEMENT IN KICKERILLO AREA WBS NO. S-000035-0185-3 HOUSTON, TEXAS

Submitted by:

GEOTEST ENGINEERING, INC.

Houston, Texas

REPORT NO. 1140194601

November 14, 2013

Key Map Nos. 488 H, M and 489 E, J

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Report No. 1140194601
November 14, 2013

Mr. David Warner, P.E.
Jones and Carter, Inc.
8701 New Trails Drive, Suite 200
The Woodlands, Texas 77381

Reference: **Geotechnical Investigation**
City of Houston Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

Dear Mr. Warner:

We are pleased to present our final geotechnical report for the above referenced project. A draft report was submitted to you on June 25, 2013. This final report supersede all previously submitted reports, transmittals etc. for the referenced project. This study was authorized by Jones and Carter, Inc. Subconsultant Agreement dated April 19, 2013 by accepting Geotest Engineering, Inc. (Geotest) Proposal No. 1140304799 dated April 8, 2013.

We appreciate this opportunity to be of service to you. If you have any questions regarding the report, or if we can be of further service to you, please call us.

Very truly yours,
GEOTEST ENGINEERING, INC.
TBPE Registration No. F-410

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EXECUTIVE SUMMARY

A geotechnical investigation was performed for the design and construction of the proposed water line replacement in the Kickerillo Area in Houston, Texas. The project calls for the design and construction of water lines replacement in Kickerillo Area in Houston, Texas. The proposed water lines replacement in Kickerillo Area is approximately 33,270 linear feet with new waterline size ranging from 4 to 8 inches in diameter. The anticipated maximum depth of new water lines range from 6 to 15 feet. The proposed water lines will generally be constructed by pipe augering. The locations of the augering pits are not known at this time. New pavement design will not be required for this project.

The purposes of this study were to evaluate soil and groundwater conditions and to provide geotechnical recommendations for the proposed water lines replacement. This investigation included drilling and sampling fifty (50) borings to depths ranging from 13 to 22 feet, installing piezometers in four (4) existing borings, performing laboratory tests on soil samples recovered from the borings, performing engineering analyses and developing geotechnical recommendations and preparing a geotechnical report.

The principal findings and conclusions developed from this investigation are as follows:

- The subsurface soil beneath pavement as encountered in borings GB-1 through GB-50 along various streets in the project area consists of predominantly cohesive soils to the explored depths of 13 to 22 feet except in borings GB-9, GB-11, GB-12, GB-14, GB-18, GB-32 and GB-35. In borings GB-9, GB-11, GB-12, GB-14, GB-18, GB-32 and GB-35, the subsurface soil beneath pavement consists of cohesive with intermittent or underlain by cohesionless soil to the explored boring depths of 13 to 22 feet. The cohesive soils consist of dark gray, gray, brown, yellowish brown and reddish brown medium stiff to hard Sandy Lean Clay, Silty Clay, Lean Clay with sand, Lean Clay, Fat Clay with sand and Fat Clay. The cohesionless soil consists of medium dense to very dense gray, reddish brown Silty Sand, Silt w/sand, Sandy Silt and Clayey Silt. In borings GB-13, GB-46 and GB-48, fill material consisting of medium stiff to stiff gray, dark gray, brown and reddish

brown Fat Clay, and medium dense brown Silty Sand with grass roots, calcareous and ferrous nodules were encountered to depths of 6 to 8 feet below the pavement.

- It is our understanding that, based on the available information provided by City of Houston, Long Point fault crosses the project area. Hence, a Phase I Fault Study will be performed in accordance with Section 11.09 of the City of Houston Design Manual and will be submitted with a final geotechnical report.

- Groundwater was encountered in borings GB-9, GB-11, GB-12, GB-13, GB-14, GB-18 and GB-22 to depths ranging from 11.0 to 14.0 feet during drilling. The groundwater level, measured 15 minutes after water was first encountered, ranged from 7.0 to 11.7 feet in these borings. No groundwater was encountered in any other borings drilled for this study including the boring converted into piezometer during the field investigation. In piezometer borings GB-1P, GB-22P and GB-49P, the water level measured at 30 days ranges from 5.7 to 11.3 feet.

- The existing paving as obtained in the soil borings GB-1 through GB-50, predominantly consists of rigid pavement consisting of 5.25 to 9.0 of concrete over 0 to 3 inches of sand and shell base. In borings GB-28 through GB-30 and GB-38 through GB-50, the existing pavement consists of 10.5 to 15.5 inches of asphalt over 0.0 to 4.0 inches of sand and shell base.

- All excavation operations should be carried out in accordance with OSHA standards and the City of Houston Standard Specifications.

- Recommendations for installation of waterlines by trenchless method (Pipe and Auger Casing) and other associated construction are included in Sections 5.2 and 5.3 of this report.

- Geotechnical parameters for design of piping system thrust restraint are provided in Section 5.4 of this report.

1.0 INTRODUCTION

1.1 General

The City of Houston selected Montgomery and Barnes, Inc., currently Jones and Carter, Inc. to perform engineering services for design and construction of water line replacement in Kickerillo Area in Houston, Texas. Montgomery and Barnes, Inc., currently Jones and Carter, Inc. retained Geotest Engineering, Inc. as part of the design team to perform geotechnical investigation for the above project.

1.2 Authorization

This study was authorized by Jones and Carter, Inc. Subconsultant Agreement on April 19, 2013 by accepting Geotest Engineering, Inc. (Geotest) Proposal No. 1140304799 dated April 8, 2013.

1.3 Location and Description of Project

The project is located in Kickerillo Area in Houston, Texas. The project area is bounded by Buffalo Bayou to the south, North Kirkwood Road to the east, Memorial Drive to the north and Winter Oaks Drive to the west, within the Key Map Page and Grid 488 H, M and 489 E, J.

The proposed water line improvements in the Kickerillo Area are shown on Figure 1, Vicinity Map.

1.4 Purpose and Scope

The purposes of this study were to evaluate soil and groundwater conditions and to provide geotechnical recommendations for the design and construction of the proposed water line replacement in Kickerillo area. The scope of this investigation consisted of the following:

- Coring the existing concrete pavement at thirty-five (35) locations to access the subsurface soils below the pavement.

- Drilling and sampling fifty (50) borings to depths ranging from 13 feet to 22 feet.

- Converting four (4) borings into piezometers to monitor long term ground water level.

- Performing appropriate laboratory tests in accordance with ASTM methods on selected samples to develop engineering properties of the soil.

- Performing engineering analyses in accordance with the City of Houston Design Manual (July 2012) to develop geotechnical recommendations for the design and construction of the proposed water line replacement in Kickerillo area.

- Preparing a geotechnical report that will include all field data, laboratory test data and geotechnical recommendations.

- Preparing a separate trench safety report for open excavation for auger pits.

2.0 FIELD INVESTIGATION

2.1 General

After obtaining the utilities clearance of proposed fifty (50) marked borings in the field, existing concrete pavement was cored at thirty-five (35) locations and borings were drilled to the explored depths at all locations including asphalt pavement boring locations. The borings were drilled utilizing a truck mounted drilling rig. Traffic control devices and personnel were utilized during coring and drilling to maintain safety of drill crew and people driving in the streets. All the drilling and sampling were performed in accordance with appropriate ASTM procedures. **It should be noted that after completion of the field work (May 2013) the water line depths was changed (June 2013) by the design consultant. At boring location GB-16, the depth of boring does not meet City of Houston design criteria, hence deepening of boring GB-16 is recommended during the design phase.**

2.2 Geotechnical Borings

Subsurface conditions were explored by drilling and sampling soil borings (designated as GB-1 through GB-50) to depths ranging from 13 to 22 feet. The approximate boring locations are shown on Figures 2.1 through 2.3, Plan of Borings. Survey information (Northing and Easting coordinates and ground surface elevation) of completed borings was provided to us by Jones and Carter, Inc. The survey information of completed borings is summarized in Table 1.

The existing concrete pavement was cored at thirty-five (35) boring locations to provide access to the subsurface soils in the borings. Borings GB-9 and GB-11 were extended an additional 5 feet due to silt was encountered at the bottom of the boring. In general, samples were obtained continuously to the termination depths of 13, 14, 15, 17, 18 and 22 feet, respectively. Cohesive soils were obtained with a 3-inch thin-walled tube sampler in general accordance with ASTM Method D 1587. Cohesionless soil samples were obtained with a 2-inch split spoon barrel in accordance with ASTM Method D 1586. Each sample was removed from the sampler in the field, carefully examined and then logged by an experienced soils technician. Suitable portions of each sample were sealed and packaged for transportation to Geotest's Laboratory. The shear strength of cohesive soil samples

was estimated using a pocket penetrometer in the field. Driving resistances for the split-barrel samples were recorded as "Blows per Foot" on the boring logs. All the borings, except the ones converted to piezometers, were grouted with cement-bentonite grout after completion of drilling and obtaining water level measurements.

Detailed descriptions of the soils encountered in the borings are given on the boring logs presented on Figures A-1 through A-50 in Appendix A. A key to symbols and terms used on boring logs is given on Figure A-51 in Appendix A.

2.3 Piezometer Installation

During the field investigation, a piezometer was installed in the open borehole of borings GB-1, GB-22, GB-36 and GB-49. The location of the piezometers, designated as GB-1P, GB-22P, GB-36P and GB-49P, is shown on Figures 2.1 through 2.3, Plan of Borings. The piezometer installation report showing the details of the construction of the piezometers are provided on Figures A-52 through A-55 in Appendix A.

The piezometers were abandoned in place after taking the final water level readings. The piezometer abandonment reports are presented in Appendix C.

3.0 LABORATORY TESTING

The laboratory testing program was designed to evaluate the pertinent physical properties and shear strength characteristics of the subsurface soils. Classification tests were performed on selected samples to aid in soil classification. All the tests were performed in accordance with ASTM Standards.

Undrained shear strengths of selected cohesive samples were measured by unconsolidated undrained (UU) triaxial tests (ASTM D 2850). The results of the UU triaxial compression tests are plotted on the boring logs as solid squares. The shear strength of cohesive samples was measured in the field with a calibrated hand pocket penetrometer and also in the laboratory with a Torvane. The shear strength values obtained from the penetrometer and Torvane are plotted on the boring logs as open circles and triangles, respectively.

Measurements of moisture content and dry unit weight were taken for each UU triaxial test sample. Moisture content (ASTM D 2216) measurements were also made on other samples to define the moisture profile at each boring location. The liquid and plastic limit tests (ASTM D 4318), sieve analysis (ASTM D422) and percent passing No. 200 sieves (ASTM D 1140) were performed on appropriate samples.

The result of all tests are tabulated or summarized on the boring logs presented on Figures A-1 through A-50 in Appendix A. The summary of laboratory tests is also presented in a tabular form on Figures B-1 through B-50 in Appendix B. The grain size distribution curves are presented on Figures B-51 and B-52 in Appendix B.

The laboratory Corrosivity tests including pH, Chloride, Sulphate and resistivity tests were performed on selected samples. The test results are presented in Appendix D and also given below.

Boring No.	***Sample No.***	***Depth, ft.***	***pH***	***Resistivity (ohm-c)***	***Chloride (mg/kg)***	***Sulphate (mg/kg)***
GB-2	S#5	8-10	7.43	1480	55.3	<10.0
GB-5	S#5	8-10	8.83	1300	65.8	<10.0
GB-6	S#4	6-8	9.35	3050	65.8	12.9
GB-7	S#4	6-8	8.17	1690	242	<10.0
GB-9	S#4	6-8	8.39	2280	46.0	<10.0
GB-13	S#6B	10-12	8.67	1640	135	31.5
GB-16	S#5	8-10	9.31	1340	20.7	<10.0
GB-17	S#7	12-14	9.91	1730	66.0	19.7
GB-22	S#7	12-14	9.29	2400	43.2	24.5
GB-24	S#6	10-12	9.15	**1000**	17.4	<10.0
GB-34	S#4	6-8	8.35	2230	41.8	13.6
GB-38	S#6	10-12	8.79	1870	20.9	<10.0
GB-41	S#6	10-12	8.02	**996**	19.5	132
GB-42	S#6	10-12	9.00	1700	34.9	14.0
GB-43	S#7	10-12	9.67	1140	38.7	10.7
GB-46	S#5	8-10	8.69	**944**	19.1	10.6
GB-48	S#7	12-14	7.94	**941**	29.2	10.7
GB-50	S#4	6-8	8.4	1630	19.5	<9.8

Based on the corrosivity test results, the degree of corrosivity of the surface soils is negligible in terms of pH, mild to corrosive in terms of soils resistivity, below threshold in terms of chloride concentration and negligible in terms of sulfate concentration. Protective measures such as cathodical protection or cement mortar coating will be required for ductile iron pipe at areas near borings GB-24, GB-41, GB-46 and GB-48. At borings GB-2, GB-5, GB-7, GB-13, GB-16, GB-17, GB-38, GB-42, GB-43 and GB-50, due to moderately corrosive nature of the soils in terms of resistivity, protective measures such as cathodical protection or cement north coating may be required for ductile iron pipe. The details of the protective measures should be performed by program corrosion specialist.

4.0 SUBSURFACE CONDITIONS

4.1 Geology

The project area lies in the Beaumont Formation. The clays and sands of the Beaumont Formation are over-consolidated as a result of desiccation from frequent rising and lowering of the sea level and the groundwater table. Consequently, clays of this formation have moderate to high shear strength and relatively low compressibility. The sands of the Beaumont Formation are typically very fine and often silty. Further, there is occasional evidence in the Houston area of the occurrence of cemented material (sandstone and siltstone) deposits within the Beaumont Formation.

4.2 General Fault Information

It is our understanding that, based on the available information provided by City of Houston, Long Point fault crosses the project area. Hence, a Phase I Fault Study will be performed in accordance with Section 11.09 of the City of Houston Design Manual and will be submitted separately in a supplemental report.

4.3 Existing Paving

The existing paving as obtained in the soil borings GB-1 through GB-50, predominantly consists of rigid pavement consisting of 5.25 to 9.0 of concrete over 0 to 3 inches of sand and shell base. In borings GB-28 through GB-30 and GB-38 through GB-50, the existing pavement consists of 10.5 to 15.5 inches of asphalt over 0.0 to 4.0 inches of sand and shell base.

The details of the existing pavement thickness at each of the boring locations are summarized below:

Boring Nos.	Asphalt Thickness (in.)	Base Thickness (in.)	Concrete Thickness (in.)	Subbase Thickness (in.)	Total (in.)
GB-1 (GB-1P)			5.5		5.5
GB-2			5.5		5.5
GB-3			5.5		5.5
GB-4			5.5		5.5
GB-5			6.25		6.25
GB-6			6.0		6.0
GB-7			6.0		6.0
GB-8			5.5		5.5
GB-9			7.0		7.0
GB-10			6.0		6.0
GB-11			9.0		9.0
GB-12			9.0		9.0
GB-13			7.75		7.75
GB-14			8.75		8.75
GB-15			6.0		6.0
GB-16			8.5		8.5
GB-17			6.0		6.0
GB-18			7.5		7.5
GB-19			5.25		5.25
GB-20			9.0		9.0
GB-21			6.75		6.75
GB-22 (GB-22P)			9.0		9.0
GB-23			6.0		6.0
GB-24			7.5		7.5
GB-25			7.0		7.0
GB-26			6.75		6.75
GB-27			6.0		6.0
GB-28			6.0		6.0
GB-29	15.5				15.5
GB-30	11.5				11.5
GB-31			6.0		6.0
GB-32			7.0		7.0
GB-33			6.0		6.0
GB-34			6.0		6.0
GB-35			6.5	3.0	9.5
GB-36 (GB-36P)			5.5	1.0	6.5
GB-37			6.5	3.0	9.5
GB-38	12.0				12.0
GB-39	12.0				12.0
GB-40	12.0				12.0

Boring Nos.	Asphalt Thickness (in.)	Base Thickness (in.)	Concrete Thickness (in.)	Subbase Thickness (in.)	Total (in.)
GB-41	14.0				14.0
GB-42	12.0				12.0
GB-43	12.0	4.0			16.0
GB-44	12.0				12.0
GB-45	12.0				12.0
GB-46	10.5				10.5
GB-47	12.0				12.0
GB-48	12.0				12.0
GB-49 (GB-49P)	10.5	1.5			12.0
GB-50	12.5				12.5

4.4 Soils Stratigraphy

Based on the subsurface soils encountered in the boreholes, seventeen (17) boring log profiles were developed and are presented on Figures 3.1 through 3.17. To the left of each boring shown on the profile is an indication of the consistency of each stratum. More than one consistency for an individual stratum indicates that the consistency is different at different depths within the stratum. For cohesive soils, consistency is related to the undrained shear strength of the soil. For cohesionless soils, the relative density is related to standard penetration resistance of the soil. To the right of each boring shown on the profile is the overall classification of the soil contained within each stratum. The symbols and abbreviations used on the boring log profile are given on Figure 4. The soil classification is based on ASTM Standards.

The subsurface soils beneath pavement as encountered in borings GB-1 through GB-50 and as shown in boring log profiles 3.1 through 3.17 along various streets in the project area are summarized below:

Boring No.	**Location/Street**	**Depth (ft)**	**Soil Description**
GB-1, GB-2, GB-3, GB-4 and GB-5	Chadbourne Drive	14 to 15	The subsurface soil beneath the pavement along Chadbourne Drive as shown on the boring log profile presented on Figure 3.1, consists of stiff to hard brown and gray and yellowish brown and gray and reddish brown and gray Sandy Lean Clay, Lean Clay with sand, Lean Clay and Fat Clay to the explored depths of 14 to 15 feet. The Fat Clay is of high to very high plasticity with liquid limits ranging from 52 to 71 and plasticity indices ranging from 31 to 45. The Lean Clay, Lean Clay with sand and Sandy Lean Clay is of high plasticity with liquid limits ranging from 42 to 46 and plasticity indices ranging from 26 to 28. The percent fines (percent passing No. 200 sieve) of Fat Clay and Lean Clay ranges from 87 to 98 percent. The percent fines of Lean Clay with sand ranges from 71 to 79 percent. The percent fines of Sandy Lean Clay is about 70 percent.

Boring No.	Location/Street	Depth (ft)	Soil Description
GB-6 through GB-10	Broadgreen Drive	15 to 22	The subsurface soil beneath the pavement along Broadgreen Drive as shown on the boring log profile presented on Figure 3.2, consists of medium stiff to hard, dark gray, gray, brown, yellowish brown and reddish brown and gray Sandy Lean Clay, Silty Clay, Lean Clay with sand, Lean Clay, Fat Clay and Fat Clay with sand to the explored depths of 15 to 22 feet. A stratum of gray Silty Sand was encountered between the depths of 12 and 13 feet in boring GB-9 and stratum of medium dense reddish brown clayey silt was encountered between depths of 15 and 17 feet in the same boring GB-9. The Fat Clay and Fat Clay with sand is of high to very high plasticity with liquid limits ranging from 53 to 75 and plasticity indices ranging from 31 to 47. The Lean Clay, Lean Clay with sand and Sandy Lean Clay are of high plasticity with liquid limits ranging from 46 to 49 and plasticity indices ranging from 25 to 30. The Silty Clay is of low plasticity with liquid limit of 27 and plasticity of 6. The percent fines of Fat Clay and Lean Clay ranges from 90 to 91 percent. The percent fines of Fat Clay w/sand and Lean Clay with sand ranges from 76 to 82 percent. The percent fines of Sandy Lean Clay is about 50 percent. The percent fines of Silty Clay is about 91 percent.

Boring No.	Location/Street	Depth (ft)	Soil Description
GB-11 through GB-14	Cindywood Lane	14 to 19	The subsurface soil beneath the pavement along Cindywood Lane as shown on the boring log profile presented on Figure 3.3, consists of medium stiff to hard, gray and yellowish brown, gray and reddish brown, Silty Clay, Lean Clay with sand, Lean Clay, Fat Clay and Fat Clay with sand to the explored depths of 14 to 19 feet. A stratum of reddish brown and gray Clayey Silt was encountered between the depths of 10 and 12 feet and 12 and 15 feet in boring GB-14 and between depths of 12 and 14 feet in boring GB-12. A stratum of medium dense to very dense gray and reddish brown Sandy Silt was encountered between depths of 12 and 19 feet in boring GB-11. Fill material consisting medium stiff to stiff gray, brown fat clay with calcareous and ferrous nodules was encountered to depth of 6 feet in boring GB-13. The Fat Clay and Fat Clay w/sand is of high plasticity with liquid limits ranging from 54 to 64 and plasticity indices ranging from 32 to 39. The Lean Clay with sand and Lean Clay are of low to high plasticity with liquid limits ranging from 28 to 43 and plasticity indices ranging from 9 to 27. The percent fines of Fat Clay and Lean Clay ranges from 93 to 100 percent. The percent fines of Lean Clay with sand and Fat Clay w/sand ranges from 71 to 84 percent. The percent fines of Sandy Silt is about 66 percent.

Boring No.	Location/Street	Depth (ft)	Soil Description
GB-15 through GB-19	Carolcrest Drive	14 to 17	The subsurface soil beneath the pavement along Carolcrest Drive as shown on the boring log profiles presented on Figure 3.4, consists of medium stiff to hard, dark gray, gray and brown, yellowish brown and gray, reddish brown and gray, Sandy Lean Clay, Lean Clay, Lean Clay with sand and Fat Clay, to the explored depths of 14 to 17 feet. A stratum of medium dense reddish brown Silt w/sand was encountered between the depths of 14 and 16 feet in boring GB-18. The Fat Clay is of high plasticity with liquid limit of about 50 and plasticity index of about 29. The Lean Clay, Lean Clay with sand and Sandy Lean Clay is of high plasticity with liquid limits ranging from 42 to 47 and plasticity indices ranging from 26 to 27. The percent fines of Fat Clay and Lean Clay ranges from 86 to 92 percent. The percent fines of Lean Clay with sand ranges from 73 to 79 percent. The percent fines of Sandy Lean Clay is about 62 percent. The percent fines of Silt w/sand is about 72 percent.
GB-20 through GB-22	Kellywood Lane	13 to 18	The subsurface soil beneath the pavement along Kellywood Lane as shown on the boring log profile presented on Figure 3.5, consists of medium stiff to hard stiff, dark gray, gray, brown, yellowish brown and reddish brown Sandy Lean Clay, Lean Clay w/sand, Fat Clay w/sand and Fat Clay to the explored depths of 13 to 18 feet. The Fat Clay and Fat Clay w/sand is of high plasticity with liquid limits ranging from 51 to 59 and plasticity indices ranging from 31 to 36. The Lean Clay w/sand and Lean Clay is of medium plasticity with liquid limit ranging from 29 to 30 and plasticity indices ranging from 12 to 15. The percent fines of Fat Clay ranges from 99 to 100 percent. The percent fines of Lean Clay w/sand and Fat Clay w/sand ranges from 76 to 83 percent.

Boring No.	Location/Street	Depth (ft)	Soil Description
GB-23 and GB-4	Rainwood Drive	13 and 14	The subsurface soil beneath the pavement along Rainwood Drive and near the intersection of Rainwood Drive and Chadbourne Drive as shown on the boring log profile presented on Figure 3.6, consists of stiff to hard, dark gray, yellowish brown and gray and reddish brown Lean Clay w/sand and Fat Clay to the explored depth of 13 and 14 feet. The Fat Clay is of high plasticity with liquid limits ranging from 63 to 67 and plasticity indices ranging from 39 to 42. The Lean Clay w/sand is about high plasticity with a liquid limit of about 46 and plasticity index of about 26. The percent fines of Fat Clay ranges from 88 to 99 percent. The percent fines of Lean Clay w/sand is about 79 percent.
GB-24 and GB-9	Clear Springs Drive	14 and 22	The subsurface soil beneath the pavement along Clear Spring Drive and near the intersection of Clear Spring Drive with Broadgreen Drive as shown on the boring log profile presented on Figure 3.7, consists of medium stiff to hard, gray and brown, yellowish brown and gray and reddish brown, Sandy Lean Clay, Silty Clay and Fat Clay to the explored depths of 14 to 22 feet. A stratum of gray Silty Sand was encountered between depths of 10 and 13 feet and medium dense reddish brown Clayey Silt was encountered between the depths of 15 and 17 feet in boring GB-9. The Fat Clay is of high plasticity with liquid limits ranging from 57 to 62 and plasticity indices ranging from 34 to 36. The Sandy Lean Clay is of high plasticity with liquid limit of about 41 and plasticity index of about 24. The Silty Clay is of low plasticity with a liquid limit of about 27 and plasticity index of about 6. The percent fines of Fat Clay and Silty Clay ranges from 90 to 93 percent. The percent fines of Sandy Lean Clay ranges from 50 to 70 percent.

Boring No.	**Location/Street**	**Depth (ft)**	**Soil Description**
GB-25	Apple Tree Lane	14	The subsurface soil beneath the pavement along Apple Tree Lane as shown on the boring log GB-25, consists of very stiff to hard, gray, yellowish brown and gray and reddish brown Lean Clay w/sand and Fat Clay to the explored depth of 14 feet. The Fat Clay is of high plasticity with a liquid limit ranging from 65 to 69 and a plasticity indices ranging from 40 to 43. The percent fines of Fat Clay ranges from 86 to 96 percent.
GB-26 and GB-27	Hickory Post Lane	13	The subsurface soil beneath the pavement along Hickory Post Lane as shown on the boring log profile presented on Figure 3.8, consists of stiff to hard, gray and yellowish brown and gray, Lean Clay with sand and Lean Clay to explored depth of 13 feet. The Lean Clay w/sand and Lean Clay are of high plasticity with liquid limits ranging from 45 to 49 and plasticity indices ranging from 26 to 28. The percent fines of Lean Clay with sand is about 80 percent and the percent fines of Lean Clay is about 88 percent.

Boring No.	Location/Street	Depth (ft)	Soil Description
GB-28 and GB-49	Apple Tree Lane	14 and 20	The subsurface soil beneath the pavement along Apple Tree Lane and near the intersection of Apple Tree Lane with White Wing Lane as shown on the boring log profile presented on Figure 3.9, consists of medium stiff to hard, gray, brown and yellowish brown and gray Lean Clay with sand and Fat Clay with sand to the explored depths of 14 to 20 feet. The Fat Clay w/sand is of high plasticity with liquid limit of about 51 and plasticity index of about 30. The Sandy Lean Clay, Lean Clay and Lean Clay with sand is of high plasticity with liquid limit of about 49 and plasticity indices ranging from 29 to 30. The percent fines of Lean Clay with sand and Fat Clay w/sand ranges from 72 to 83 percent.
GB-29 and GB-43	Blue Bird Lane	20	The subsurface soil beneath the pavement along Blue Bird Lane and near the intersection of Blue Bird Lane and Rancho Bauer Drive as shown on the boring log profile presented on Figure 3.10, consists of medium stiff to hard, dark gray, gray and yellowish brown and reddish brown Sandy Lean Clay, Lean Clay w/sand and Fat Clay to explored depths of 20 feet. The Sandy Lean Clay and Lean Clay with sand is of medium to high plasticity with a liquid limits ranging from 28 to 46 and plasticity indices ranging from 15 to 26. The percent fines of Lean Clay with sand is about 77 percent and the percent fines of Sandy Lean Clay ranges from 65 to 68 percent.

Boring No.	Location/Street	Depth (ft)	Soil Description
GB-30 and GB-42	Cardinal Lane	15 and 20	The subsurface soil beneath the pavement along Cardinal Lane and near the intersection of Cardinal Lane with Rancho Bauer Drive as shown on the boring log profile presented on Figure 3.11, consists of stiff to hard, dark gray and gray and yellowish brown Lean Clay with sand and Fat Clay to explored depths of 15 and 20 feet. The Fat Clay is of high plasticity with liquid limit of about 55 with plasticity index of about 35. The Lean Clay with sand is of high plasticity with liquid limits ranging from 43 to 47 and plasticity indices ranging from 24 to 27. The percent fines of Fat Clay is about 87 percent. The percent fines of Lean Clay with sand ranges from 75 to 83 percent.
GB-31	Cindywood Circle	15	The subsurface soil beneath the pavement along Cindywood Circle as shown on the boring log GB-31 consists of medium stiff to very stiff gray Sandy Lean Clay and Lean Clay w/sand to the explored depth of 15 feet. The Lean Clay w/sand and Sandy Lean Clay is of medium to high plasticity with liquid limits ranging from 30 to 48 and plasticity indices ranging from 14 to 29. The percent fines of Lean Clay w/sand is about 82 percent and the percent fines of Sandy Lean Clay is about 66 percent.
GB-32	Carolcrest Drive	18	The subsurface soil beneath pavement along Carolcrest Drive as shown on boring log GB-32, consists of medium stiff to hard gray and yellowish brown Lean Clay w/sand to the explored depth of 18 feet. A stratum of medium dense gray Sandy Silt is encountered between depths of 10 and 12 feet. The Lean Clay w/sand is of medium to high plasticity with liquid limits ranging from 34 to 41 and plasticity indices ranging from 17 to 25. The percent fines of Lean Clay w/sand ranges from 80 to 82 percent. The percent fines of Sandy Silt is about 50 percent.

Boring No.	**Location/Street**	**Depth (ft)**	**Soil Description**
GB-33	Kellywood Lane	14	The subsurface soil beneath pavement along Kellywood Lane as shown on boring log GB-33 consists of medium stiff to very stiff gray, yellowish brown Fat Clay and Sandy Lean Clay to the explored depth of 14 feet. The Sandy Lean Clay is of medium plasticity with a liquid limit of about 31 and a plasticity index of 16. The percent fines of Sandy Lean Clay is about 66 percent.
GB-34 and GB-35	River Forest Drive	15	The subsurface beneath pavement along River Forest Drive as shown on boring log profile presented on Figure 3.12 consists of medium stiff to hard gray, brown and yellowish brown Sandy Lean Clay and Lean Clay w/sand to the explored depth of 15 feet. A stratum of medium dense gray Sandy Silt is encountered between depths of 12 and 13.5 feet in boring GB-35. The Lean Clay w/sand is of medium to high plasticity with liquid limit ranging from 31 to 42 and plasticity indices ranging from 15 to 24. The percent fines of Lean Clay w/sand ranges from 71 to 78 percent. The percent fines of Sandy Silt is about 56 percent.
GB-36 and GB-37	Heatherfield Drive	14	The subsurface soil beneath pavement along Heatherfield Drive and as shown on boring log profile presented on Figure 3.13 consists of medium stiff to hard gray, brown, yellowish brown Lean Clay w/sand and Lean Clay to the explored depth of 14 feet. The Lean Clay w/sand and Lean Clay is of medium to high plasticity with liquid limits ranging from 31 to 44 and plasticity indices ranging from 16 to 24. The percent fines of Lean Clay ranges from 91 to 95 percent and the percent fines of Lean Clay w/sand ranges from 72 to 81 percent.

Boring No.	**Location/Street**	**Depth (ft)**	**Soil Description**
GB-38 through GB-44	Rancho Bauer Drive	15 to 20	The subsurface soil beneath pavement along Rancho Bauer Drive as shown on boring log profile presented on Figures 3.14 and 3.15 consists of medium stiff to hard dark gray, gray, brown, yellowish brown and reddish brown Sandy Lean Clay, Lean Clay w/sand, Fat Clay w/sand and Fat Clay to explored depths of 15 to 20 feet. The Fat Clay and Fat Clay w/sand is of high plasticity with liquid limits ranging from 51 to 73 and plasticity indices ranging from 30 to 44. The Sandy Lean Clay, Lean Clay w/sand and Lean Clay is of medium to high plasticity with liquid limit ranging from 28 to 47 and plasticity indices ranging from 15 to 29. The percent fines of Fat Clay and Lean Clay ranges from 85 to 89 percent. The percent fines of Fat Clay w/sand and Lean Clay w/sand ranges from 74 to 83 percent. The percent fines of Sandy Lean Clay is about 65 percent.
GB-45 through GB-50	White Wing Lane	15 to 20	The subsurface soil beneath pavement along White Wing Lane as shown on boring log profile presented on Figures 3.16 and 3.17 consists of medium stiff to hard gray, brown, yellowish brown, reddish brown Sandy Lean Clay, Lean Clay w/sand, Fat Clay w/sand and Fat Clay to explored depths of 15 and 20 feet. Fill material consisting of medium stiff to very stiff, gray, brown Fat Clay and medium dense brown Silty Sand was encountered to depths of 6 and 8 feet in borings GB-46 and GB-48. The Fat Clay and Fat Clay w/sand is of high plasticity with liquid limit ranging from 51 to 58 and plasticity indices ranging from 30 to 35. The Sandy Lean Clay, Lean Clay w/sand is of medium to high plasticity with liquid limits ranging from 32 to 49 and plasticity indices ranging from 17 to 30. The percent fines of Lean Clay and Fat Clay ranges from 87 to 90 percent. The percent fines of Fat Clay w/sand and Lean Clay w/sand ranges from 72 to 85 percent. The percent fines of Sandy Lean Clay ranges from 68 to 70 percent.

4.5 Water Levels

Groundwater was encountered in borings GB-9, GB-11, GB-12, GB-13, GB-14, GB-18 and GB-22 to depths ranging from 11.0 to 14.0 feet during drilling. The groundwater level, measured 15 minutes after water was first encountered, ranged from 7.0 to 11.7 feet in these borings. No groundwater was encountered in any other borings drilled for this study including the boring converted into piezometer during the field investigation. In piezometer borings GB-1P, GB-22P and GB-49P, the water level measured at 30 days ranges from 5.7 to 11.3 feet. The water level encountered in borings is summarized below.

Boring No.	Location/Street Name	Groundwater Depth During Drilling (ft)	Groundwater Depth After 24 Hours (ft)	Groundwater Depth After 30 Days (ft)
GB-1 (GB-1P)	**Chadbourne Drive**	**Dry**	**11.7**	**11.3 on 6-8-13**
GB-2	Chadbourne Drive	Dry	N/A	N/A
GB-3	Chadbourne Drive	Dry	N/A	N/A
GB-4	Chadbourne Drive	Dry	N/A	N/A
GB-5	Chadbourne Drive	Dry	N/A	N/A
GB-6	Broadgreen Drive	Dry	N/A	N/A
GB-7	Kickerillo Drive	Dry	N/A	N/A
GB-8	Broadgreen Drive	Dry	N/A	N/A
GB-9	Broadgreen Drive	8.3	N/A	N/A
GB-10	Broadgreen Drive	Dry	N/A	N/A
GB-11	Cindywood Drive	11.7	N/A	N/A
GB-12	Cindywood Drive	7.3	N/A	N/A
GB-13	Cindywood Drive	10.4	N/A	N/A
GB-14	Cindywood Drive	8.6	N/A	N/A
GB-15	Carolcrest Drive	Dry	N/A	N/A
GB-16	Carolcrest Drive	Dry	N/A	N/A
GB-17	Carolcrest Drive	Dry	N/A	N/A
GB-18	Carolcrest Drive	7.0	N/A	N/A
GB-19	Carolcrest Drive	Dry	N/A	N/A

Boring No.	Location/Street Name	Groundwater Depth During Drilling (ft)	Groundwater Depth After 24 Hours (ft)	Groundwater Depth After 30 Days (ft)
GB-20	Kellywood Lane	Dry	N/A	N/A
GB-21	Kellywood Lane	Dry	N/A	N/A
GB-22 (GB-22P)	**Kellywood Lane**	**11.7**	**8.2**	**4.7 on 6-8-13**
GB-23	Rainwood Drive	Dry	N/A	N/A
GB-24	Clear Spring Drive	Dry	N/A	N/A
GB-25	Apple Tree Road	Dry	N/A	N/A
GB-26	Hickory Post Lane	Dry	N/A	N/A
GB-27	Beverly Hill	Dry	N/A	N/A
GB-28	Apple Tree Lane	Dry	N/A	N/A
GB-29	Blue Bird Lane	Dry	N/A	N/A
GB-30	Cardinal Lane	Dry	N/A	N/A
GB-31	Cindywood Circle	Dry	N/A	N/A
GB-32	Carolcrest Drive	Dry	N/A	N/A
GB-33	Kellywood Lane	Dry	N/A	N/A
GB-34	River Forest Drive	Dry	N/A	N/A
GB-35	River Forest Drive	Dry	N/A	N/A
GB-36 (GB-36P)	**Heatherfield Drive**	**Dry**	**Dry**	**Dry**
GB-37	Heatherfield Drive	Dry	N/A	N/A
GB-38	Rancho Bauer Drive	Dry	N/A	N/A
GB-39	Rancho Bauer Drive	Dry	N/A	N/A
GB-40	Rancho Bauer Drive	Dry	N/A	N/A
GB-41	Rancho Bauer Drive	Dry	N/A	N/A
GB-42	Rancho Bauer Drive	Dry	N/A	N/A
GB-43	Rancho Bauer Drive	Dry	N/A	N/A
GB-44	Rancho Bauer Drive	Dry	N/A	N/A
GB-45	White Wing Lane	Dry	N/A	N/A

Boring No.	Location/Street Name	Groundwater Depth During Drilling (ft)	Groundwater Depth After 24 Hours (ft)	Groundwater Depth After 30 Days (ft)
GB-46	White Wing Lane	Dry	N/A	N/A
GB-47	White Wing Lane	Dry	N/A	N/A
GB-48	White Wing Lane	Dry	N/A	N/A
GB-49 (GB-49P)	**White Wing Lane**	**Dry**	**5.7**	**5.7 on 6-8-13**
GB-50	White Wing Lane	Dry	N/A	N/A

However, it should be noted that various environmental and man-made factors such as amount of precipitation, nearby subsurface construction activities, and change in area drainage can substantially influence the groundwater level.

4.6 Environmental Concerns

No environmental concerns were observed or noticed in any of the borings (GB-1 through GB-50) drilled for this study.

5.0 ENGINEERING ANALYSES AND RECOMMENDATIONS

5.1 General

The proposed water line improvements in the Kickerillo Area are shown on Figure 1 "Vicinity Map."

5.2 Trench Excavation (Auger Pits)

Based on the information provided by Jones and Carter, Inc., it is understood that the water line replacement will be by trenchless method of construction. The following subsections provide information for the design and construction of the water lines and the excavations required for the proposed auger pit installation.

5.2.1 Geotechnical Parameters. Based on the soil conditions revealed by the borings GB-1 through GB-50, geotechnical parameters were developed for the design of auger pit construction as part of the water line replacement. The design parameters are provided in Table 2. For design, the groundwater level should be assumed to exist at the ground surface.

5.2.2 Excavation Stability (Auger Pits). The open excavation may be shored or laid back to a stable slope or supported by some other equivalent means used to provide safety for workers and adjacent structures, if any. The excavating operations should be in accordance with OSHA Standards, OSHA 2207, Subpart P, latest revision and the City of Houston Standard Specification.

- Excavation Shallower Than 5 Feet - Excavations that are less than 5 feet deep **(critical height)** should be effectively protected when an indication of dangerous ground movement is anticipated.
- Excavations Deeper Than 5 Feet - Excavations that are deeper than 5 feet should be sloped, shored, sheeted, braced or laid back to a stable slope or supported by some other equivalent means or protection such that workers are not exposed to moving ground or cave-ins. The

slopes and shoring should be in accordance with the trench safety requirements as per OSHA Standards. The following items provide design criteria for excavation stability.

(i) OSHA Soil Type. Based on the soil conditions revealed by borings drilled for this study and assumed groundwater level at surface, OSHA soil type "C" should be used for determination of allowable maximum slope and/or the design of shoring along the alignment for full proposed depth of open excavation. For shoring deeper than 20 feet (if needed), an engineering evaluation is required and deeper soil borings will be needed.

(ii) Excavation Support Earth Pressure. Based on the subsurface conditions indicated by our field investigation and laboratory testing results, excavation support earth pressure diagrams were developed and are presented on Figures 5.1 through 5.3. These pressure diagrams can be used for the design of temporary trench bracing. For a trench box, a lateral earth pressure resulting from an equivalent fluid with a unit weight of 96 pcf can be used. The effects of any surcharge loads at the ground surface should be added to the computed lateral earth pressures. A surcharge load, q, will typically result in a lateral load equal to 0.5 q. The above value of equivalent fluid pressure is based on assumption that the groundwater level is near the ground surface, since these conditions may exist after a heavy rain or flooding.

(iii) Bottom Stability. In braced cuts, if tight sheeting is terminated at the base of the cut, the bottom of the excavation can become unstable. The parameters that govern the stability of the excavation base are the soil shear strength and the differential hydrostatic head between the groundwater level within the retained soils and the groundwater level at the interior of the trench excavation. For cut in cohesive soils as predominantly encountered for the proposed excavation depths in most of the borings, the bottom stability can be evaluated as outlined on Figure 6. However, at locations near borings GB-9, GB-14 and GB-32 where cohesionless soils (such as silty sand, clayey silt and sandy silt) were encountered between depths of 10 and 20

feet (at invert or within 3 feet of bottom of excavation), dewatering will be necessary to avoid bottom stability problems.

5.2.3 Groundwater Control. Excavations for the water line may encounter groundwater seepage to varying degrees depending upon the groundwater conditions at the time of construction and the location and depth of the trench. Based on the soil conditions identified in the borings for the proposed water line replacement, all the excavations (auger pits) will be in cohesive soils.

In general for cohesive soils as predominantly encountered for most of the borings for the excavation depths, the groundwater if encountered may be managed by collection in excavation bottom sumps for pumped disposal. However, in borings GB-9, GB-14 and GB-32 where cohesionless soils were encountered at invert or within 3 feet of bottom of the excavation; dewatering will be required. Dewatering such as vacuum well points up to 15 feet or deep wells with submersible pumps for excavation greater than 15 feet may be required to lower the groundwater level to at least 5 feet below the bottom of the excavation (auger pits). It is recommended that the actual groundwater conditions should be verified by the contractor at the time of construction and that groundwater control should be performed in general accordance with the City of Houston Standard Specifications, Section 01578.

5.2.4 Auger Pit Backfill. The excavated auger pits should be backfilled per the City of Houston Standard Specification Section 02447, Subsection 3.04 and Drawing No. 02447-01.

5.3 Trenchless Installation - Pipe and Auger Casing

It is understood that the proposed water lines will be installed using trenchless method.

5.3.1 Geotechnical Parameters for Pipe and Auger Casing. Based on the soil conditions revealed by borings GB-1 through GB-50 and laboratory test data, geotechnical design parameters were developed for cohesive soils and cohesionless soils for Pipe and Auger Casing installation and are provided in Table 3. For design conditions, the groundwater levels should be assumed to exist at the ground surface.

5.3.2 Earth Pressure on Auger Casing. The earth pressures on the auger casing should be determined from Figure 7. Equations to calculate the tunnel liner loads are also shown in Figure 7. For crossing under the major roads, the stress due to traffic loads should be considered.

5.3.3 Live Loads on Pipeline Due to Traffic. Loads on the pipe due to traffic should be considered. A graph providing calculated vertical stress on pipe due to traffic loads is given on Figure 8.

5.3.4 Carrier Pipe Design Parameters. Carrier pipe must be sufficiently strong to withstand anticipated long-term ground loads and must not be subject to deterioration by substance either in the ground or in the auger casing. The carrier pipe design should include consideration of not only the loads applied to the pipe but also factors other than soil loading. These factors could include minimum structural code requirements, loading from pipe jacking operations and other construction loads. The drained geotechnical design parameters given in Table 3 should be used in analyzing the soil structure interaction of the carrier pipe.

5.4 Piping System Thrust Restraint

Unbalanced thrust forces will occur at any point in the pipe where the direction or cross sectional area of the flow changes. The force diagram shown in Figure 9 illustrates the thrust force generated by flow at a bend in the pipe. The equations for computing this thrust force are also given in this figure. The thrust force will often require more resistance or support than is available just from the pipe bearing against the backfill. In order to prevent intolerable movement and overstressing of the pipe, suitable buttressing should be provided.

Based on the drawings provided to us, it was noted that several horizontal bends are proposed which may require restraint in addition to that supplied by the pipe bearing on the backfill. In general, thrust blocks, both horizontal and vertical and restrained joints are common methods of supplying additional reaction. However, it is noted that restrained joints are considered for supplying additional reaction for the project and is discussed below.

5.4.1 Restrained Joints. Where thrust blocks are not practical, restrained joints, allowing thrust and shear forces to be transmitted across the pipe joints, are employed to allow a number of pipe sections to act integrally in bearing. The equations necessary to determine the restrained pipe length on each side of the bend are given below:

$$L = \frac{PA\ (1 - Cos\theta)}{\mu(W_e + W_p + W_w)}$$

where, L = restrained pipe length on each side of the bend, in feet

P = internal pressure, in pounds per square inch

A = cross sectional area of first unrestrained pipe joint, in square inches

θ = deflection angle of bend, in degrees

μ = co-efficient of friction between pipe and soil (recommended 0.3)

W_e = overburden load, in pounds per liner foot = $\Upsilon_b\ B_c H$

W_p = weight of pipe, in pounds per linear foot

W_w = weight of water in pipe, in pounds per linear foot

Υ_b = wet unit weight of backfill material, in pounds per cubic foot (recommended 120 pcf)

B_c = pipe outer diameter, in feet

H = earth cover, in feet

Reinforced concrete encasement may be used in lieu of the manufactured joint restrained system. The equations and soil parameters given above can be used for the design of reinforced concrete encasement.

5.5 Influence of Trenchless Operation on Adjacent Structures

Surface and near-surface structures near the pipe and casing augering primarily consist of residential buildings, city streets and public utilities.

Ground movement, in terms of loss of ground or ground lost, is commonly associated with soft ground augering. If such ground movement is excessive, it may cause damage to the structures, roads and services located above the auger casing. While ground movement cannot be eliminated, it can be controlled within certain limits by the use of proper construction techniques and good quality workmanship. These include, but are not limited to, prevention of excessive ground loss during trenchless operation with the use of grouting and filling the annular space between the pipe or casing and the surrounding soil and prevention of undue loss of fines through dewatering.

The selection and execution of trenchless methods that are best suited to anticipated ground conditions along the proposed auger casing are, in fact, the contractor's primary contribution to successful completion of the proposed auger casing. Review of the boring logs revealed that the ground conditions for augering (excavation face) will be primarily through Sandy Lean Clay, Lean Clay with sand, Lean Clay, Fat Clay and Fat Clay with sand. The cohesive soils within the natural soils are medium stiff to very stiff in consistency and the ground in this area may be expected to behave as squeezing to raveling ground near the invert. The existing natural soils consisting of Sandy Silt, Silty Sand and Clayey Silt was encountered near the proposed invert depths of trenchless installation in borings GB-9, GB-14 and GB-32. The cohesionless soils (silty sand, sandy silt and clayey silt) within the natural soils are medium dense and the ground at these locations may be expected to behave raveling to running ground near the invert depths. Hence, extra precautions will be required at these locations during the trenchless installation to prevent any excessive ground loss due to the disturbance and removal of the cohesionless soils. Close monitoring of ground movement should be carried out during the trenchless installation.

The extra precautions may include:

- Shorten duration between auger excavation and pushing of casing/pipe as minimum as possible.
- Alternatively use steel pipe in these areas.
- If any excessive ground loss is observed during closed monitoring, grouting will be required to fill any voids.

At locations near borings GB-9, GB-14 and GB-32, the ground conditions for trenchless operation (excavation face) will be through cohesive soil interface with cohesionless soils or in cohesionless soils. In such conditions, dewatering will be necessary.

The proposed auger casing is parallel with or crosses beneath a number of water, gas, power, telephone and storm and sanitary sewer lines. The largest potential problems from utilities may result from:

- Leaking water pipes
- Gas pipe breakage leading to a potential explosion
- Breakage of storm or sanitary sewers

In general, it is the contractor's responsibility to investigate these and other possible third party interactions along the proposed water line alignment and to accommodate all of these interactions with the use of good construction methods.

5.6 Pavement Repair and Subgrade Stabilization

The pavement repair at the auger pit locations and other locations where required should be performed in accordance with City of Houston Standard Specification No. 02951 "Pavement Repair and Restoration" and City of Houston Standard Drawing Nos. 02951-01, 02 and 03.

The subgrade stabilization for the pavement repair should be performed as described below.

Based on the field and laboratory test data, the surficial subgrade soils in the project area consists of predominantly cohesive soils (sandy lean clay, lean clay and fat clay) with high plasticity. These high plasticity cohesive soils should be stabilized with a minimum of 6% hydrated lime (by dry unit weight) to a depth of minimum 6-inches.

The lime stabilization of clay subgrade should be performed in accordance with City of Houston Standard Specification No. 02336 "Lime Stabilized Subgrade."

6.0 CONSTRUCTION CONSIDERATIONS

6.1 Auger Pit Excavation and Water Line Construction

Whenever practical, excavations should be performed during dry weather. All excavated areas (auger pits) should be adequately protected from surface run-off water with appropriate measures to prevent ponding of water in and around the excavation. Excavations should be properly sloped, shored, braced, or protected in accordance with OSHA's excavation safety standard, 29CFR Part 1926, Subpart P (Excavations and Trenches) Standards.

The selection and execution of augering methods that are best suited to anticipate ground conditions along the proposed auger casing should be contractor's primary responsibility for successful completion of proposed augering. The anticipated ground conditions for augering (excavation force) are discussed in Section 5.5.

6.2 Groundwater Control

Auger pit excavations may encounter groundwater seepage. It is our opinion that in cohesive soils, as encountered in most of the borings for the proposed excavation depths, the groundwater may be collected in excavation bottom sumps for pumped disposal. However, in borings GB-9, GB-14 and GB-32 where cohesionless soils were encountered at invert or within 3 feet of bottom of the excavation; dewatering will be required. Dewatering such as vacuum well points up to 15 feet or deep wells with submersible pumps for excavation greater than 15 feet may be required to lower the groundwater level to at least 3 feet below the bottom of the excavation (auger pits). The contractor should verify the groundwater level at the time of construction and should provide an adequate dewatering system, where required.

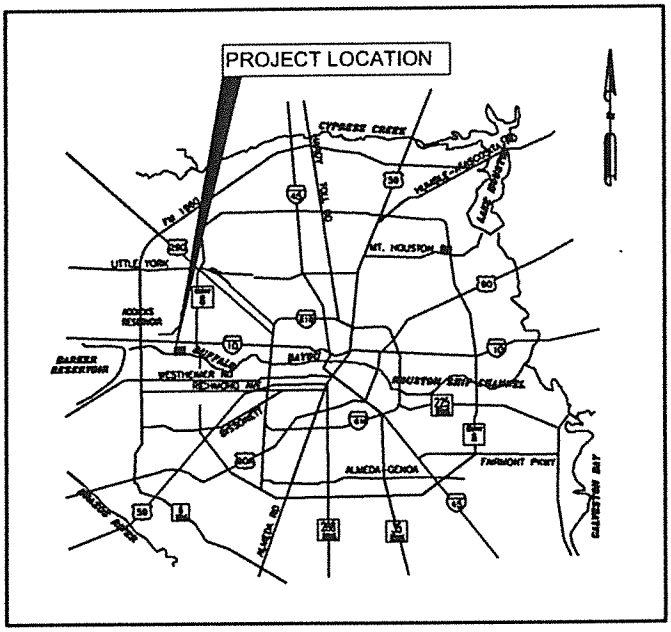
7.0 LIMITATIONS

The description of subsurface conditions and the design information contained in this report are based on the soil borings made at the time of drilling at specific locations. However, some variation in soil conditions may occur between soil borings. Should any subsurface conditions other than those described in our boring logs be encountered, Geotest should be immediately notified so that further investigation and supplemental recommendations can be provided. The depth of the groundwater level may vary with changes in environmental conditions such as frequency and magnitude of rainfall. The stratification lines on the log of borings represent the approximate boundaries between soil types, however, the transition between soil types may be more gradual than depicted.

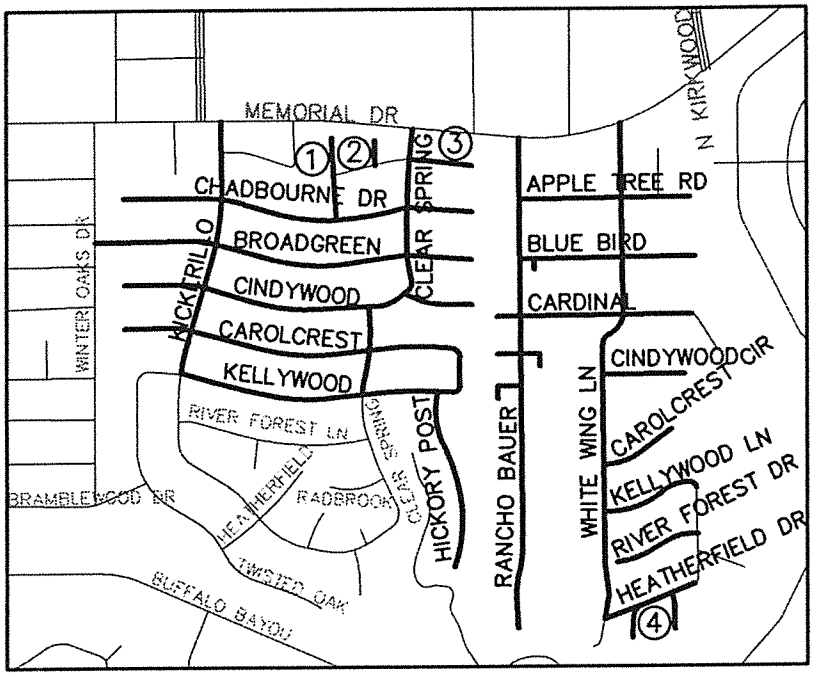
This report has been prepared for the exclusive use of City of Houston, Texas, and Jones and Carter, Inc. for the Water Line Replacement in Kickerillo Area in Houston, Texas. This report shall not be reproduced without the written permission of Geotest Engineering, Inc., The City of Houston or Jones and Carter, Inc.

ILLUSTRATIONS

Job No. 1140194601



LOCATION MAP



KICKERILLO
PROJECT LOCATION

KEY MAP NO.: 488H, M & 489 E, J

VICINITY MAP

Job No.: 1140194601

70% SUBMITTAL

No. Date Revisions App

MEMORIAL DR

APPLE TREE RD (WEST)

APPLE TREE CT

CLEAR SPRING DR (NORTH)

RANNWOOD DR

CHADBOURNE DR

BROADGREEN DR

CINDYWOOD DR (CUL DE SAC)

CINDYWOOD DR

KICKERILLO DR

WINTER OAKS DRIVE

CAROLCREST DRIVE

CLEAR SPRING DR (SOUTH)

HICKORY POST

KELLYWOOD LN (WEST)

GB-1 (GB-1P) GB-2 GB-3 GB-4 GB-5 GB-6 GB-7 GB-8 GB-9 GB-10 GB-11 GB-12 GB-13 GB-14 GB-15 GB-16 GB-17 GB-18 GB-19 GB-20 GB-21 GB-22 (GB-22P) GB-23 GB-24 GB-25

SHEET 17 SHEET 18 SHEET 19 SHEET 20 SHEET 21 SHEET 22 SHEET 23 SHEET 24 SHEET 25 SHEET 26 SHEET 27 SHEET 28 SHEET 29 SHEET 30 SHEET 31 SHEET 32 SHEET 33 SHEET 34 SHEET 35 SHEET 36 SHEET 37 SHEET 38 SHEET 39 SHEET 40 SHEET 41 SHEET 42 SHEET 43 SHEET 44 SHEET 45 SHEET 46 SHEET 47 SHEET 48

SHEET 49 SHEET 50 SHEET 51 SHEET 52 SHEET 53 SHEET 54 SHEET 55 SHEET 56 SHEET 57 SHEET 58 SHEET 59 SHEET 60 SHEET 61 SHEET 65

1-16"x 8" TSV & BOX
1-8" CUT & PLUG

1-6" WET CONNECTION
1-6" CUT & PLUG

1-2" BLOW OFF VALVE

1-4" WET CONNECTION
1-4" CUT & PLUG

PROP 8" WATER LINE

PROP 6" WATER LINE

PROP 4" WATER LINE

1-8"x6" TS&V
1-6"x4" REDUCER, AB
1-4" CUT & PLUG

1-8" WET CONNECTION
1-8"x6" REDUCER, AB

1-8"x6" REDUCER, AB

2-8"x 8" TSV & BOX
2-6" CUT & PLUG

1-8" WET CONNECTIONS
1-8" CUT & PLUGS

1-6" CUT & PLUG

EXIST FIRE HYDRANT TO REMAIN IN SERVICE

1-6" WET CONNECTION
1-6" CUT & PLUG

R/S FH

10' UTIL. ESMT.

10' UTIL. ESMT. & B.L.

10' W.L. ESMT.

8" water line

6" water line

4" water line

15" water line

8" water line (By Others)

6" water line (By Others)

chgnd. 8" water line

chgnd. 6" water line

3'X35' G.E.

MATCH LINE STA - SEE SHEET 07

MATCH LINE STA- SEE SHEET 06

BENCHMARK:

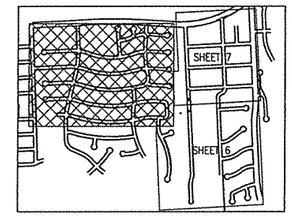
CITY OF HOUSTON MARKER 210175. FROM THE INTERSECTION OF MEMORIAL DRIVE AND NORTH KIRKWOOD DRIVE, TRAVEL SOUTH ON KIRKWOOD DRIVE TO BRIDGE OVER BUFFALO BAYOU. MONUMENT IS LOCATED ON EAST SIDE OF BRIDGE

EL=77.37
HORIZONTAL DATUM: NAD83, TEXAS SOUTH CENTRAL 4204
VERTICAL DATUM: NAVD88, 2001 ADJUSTMENT, GEOID99 (CONUS)

LEGEND:

- PROPOSED WATER LINE
- PROPOSED FIRE HYDRANT
- PROPOSED GV & BOX
- PROPOSED WET CONNECTION
- PROPOSED TSV & BOX
- PROPOSED CUT & PLUG
- R/S FH — REMOVE & SALVAGE EXIST FIRE HYDRANT
- EXISTING WATER LINE
- EXISTING WATER VALVES
- EXISTING WATER METER
- EXISTING PIPE REDUCER

- FLOOD WAY
- 100YR FLOOD PLAN
- 500YR FLOOD PLAN



OVERALL LAYOUT MAP

Legend:
- Boring
- Boring with Piezometer

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TBPE Firm Registration No. F-4951

DATE: JUNE 2013 CHECKED BY: SP
DESIGNED BY: YS DRAWN BY: JV/SS
SURVEYED BY: CIVILCORP
FB NO. X-XXXX

THESE PLANS ARE PRELIMINARY AND ARE BEING ISSUED FOR REVIEW BY PUBLIC AGENCIES AND OTHER PRELIMINARY PURPOSES. WHEN ISSUED IN FINAL FORM

BY THE RESPONSIBLE ENGINEER.

RESPONSIBLE ENGINEER:
KIT Professionals, Inc.
SRIKANTH PUNUKULA, P.E.
TEXAS REGISTRATION NO.: 88614

JUNE, 2013

CITY OF HOUSTON

DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

WATER LINE REPLACEMENT IN KICKERILLO AREA

PLAN OF BORINGS

WBS NO. S-000035-0185-3
DRAWING SCALE
SCALE 1" = 200'
CITY OF HOUSTON, PM
VENUS NAHID P.E.
SHEET NO. 5 OF 147

0 1 2 3 ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

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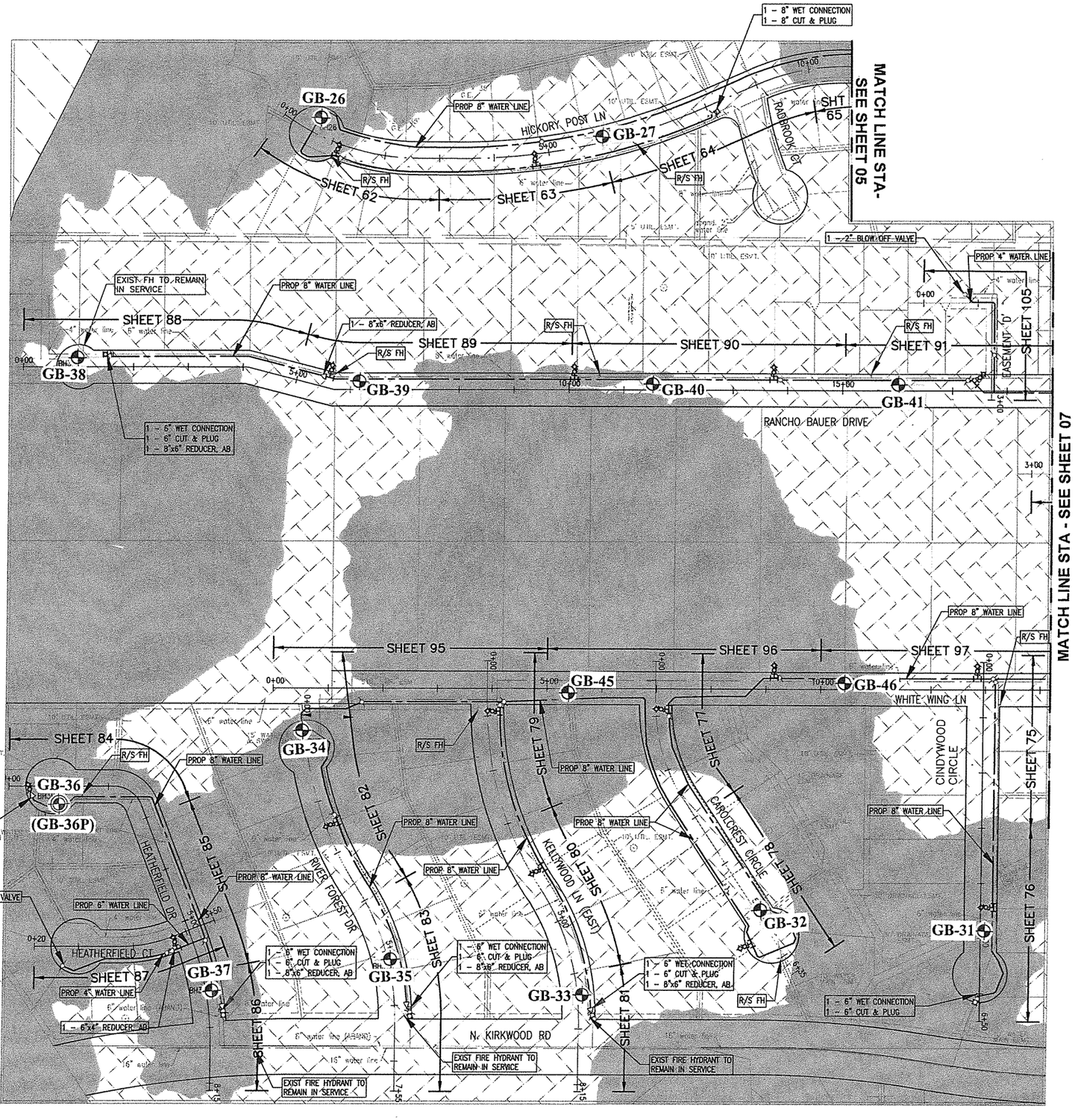
FIGURE 2.1

Job No.: 1140194601



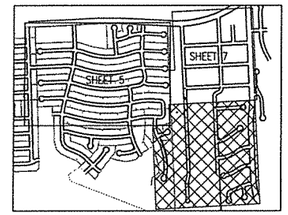
BENCHMARK:

CITY OF HOUSTON MARKER 210175. FROM THE INTERSECTION OF MEMORIAL DRIVE AND NORTH KIRKWOOD DRIVE, TRAVEL SOUTH ON KIRKWOOD DRIVE TO BRIDGE OVER BUFFALO BAYOU. MONUMENT IS LOCATED ON EAST SIDE OF BRIDGE

EL=77.37
HORIZONTAL DATUM: NAD83, TEXAS SOUTH CENTRAL 4204
VERTICAL DATUM: NAVD88, 2001 ADJUSTMENT, GEOID99 (CONUS)

LEGEND:

- PROPOSED WATER LINE
- PROPOSED FIRE HYDRANT
- PROPOSED GV & BOX
- PROPOSED WET CONNECTION
- PROPOSED TSV & BOX
- PROPOSED CUT & PLUG
- R/S FH — REMOVE & SALVAGE EXIST FIRE HYDRANT
- EXISTING WATER LINE
- EXISTING WATER VALVES
- EXISTING WATER METER
- EXISTING PIPE REDUCER
- BH01 — SOIL BORING W/BORE HOLE NUMBER
- FLOOD WAY
- 100YR FLOOD PLAN
- 500YR FLOOD PLAN



OVERALL LAYOUT MAP

Legend:

- Boring
- Boring with Piezometer

No.	Date	Revisions	App

70% SUBMITTAL

JONES & CARTER, INC.
ENGINEERS • PLANNERS • SURVEYORS
Texas Board of Professional Engineers Registration No. F-439
6335 Gulfton Dr., Suite 100 Houston, Texas 77081 (713) 777-5337

KIT Professionals, Inc.
Engineers & Planners & Construction Managers
3535 Wilcrest Dr., Suite 600
Houston, Texas 77042
Phone: (713)783-6700 Fax: (713)783-6747
TBPE Firm Registration No. F-4091

THESE PLANS ARE PRELIMINARY AND ARE BEING ISSUED FOR REVIEW BY PUBLIC AGENCIES AND OTHER PRELIMINARY PURPOSES. WHEN ISSUED IN FINAL FORM

BY THE RESPONSIBLE ENGINEER.

RESPONSIBLE ENGINEER:
KIT Professionals, Inc.
SRIKANTH PUNUKULA, P.E.
TEXAS REGISTRATION NO.: 85614

JUNE, 2013

DATE: JUNE 2013 CHECKED BY: SP
DESIGNED BY: TS DRAWN BY: JW/SS
SURVEYED BY: CMLCORP
FB NO. X-XXXX

CITY OF HOUSTON

DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

WATER LINE REPLACEMENT IN KICKERILLO AREA

PLAN OF BORINGS

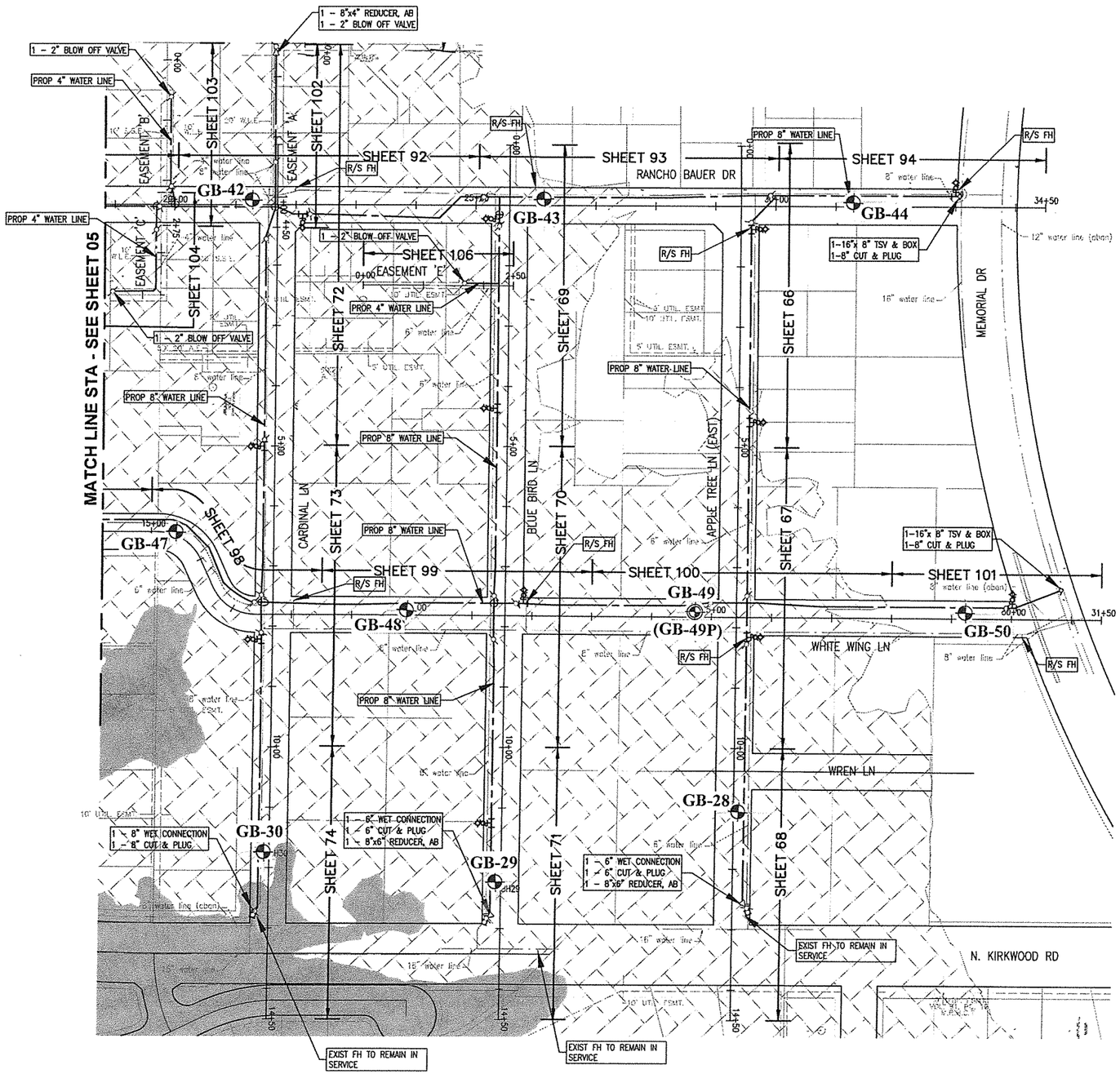
WBS NO.	S-000035-0185-3
DRAWING SCALE	SCALE 1" = 200'
CITY OF HOUSTON, PM	VENUS NAHID P.E.
SHEET NO. 6 OF 147	

0 1 2 3 ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

R:\352 Mas\1101\PROD\3.2_CAD\3.2.2 General\Overall Layout.dwg

FIGURE 2.2

Job No.: 114019460l



BENCHMARK:

CITY OF HOUSTON MARKER 210175. FROM THE INTERSECTION OF MEMORIAL DRIVE AND NORTH KIRKWOOD DRIVE, TRAVEL SOUTH ON KIRKWOOD DRIVE TO BRIDGE OVER BUFFALO BAYOU. MONUMENT IS LOCATED ON EAST SIDE OF BRIDGE

EL=77.37
HORIZONTAL DATUM: NA083, TEXAS SOUTH CENTRAL 4204
VERTICAL DATUM: NAVD88, 2001 ADJUSTMENT, GEOID99 (CONUS)

No.	Date	Revisions	App

70% SUBMITTAL

LEGEND:

- PROPOSED WATER LINE
- PROPOSED FIRE HYDRANT
- PROPOSED GV & BOX
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- PROPOSED TSV & BOX
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- EXISTING WATER VALVES
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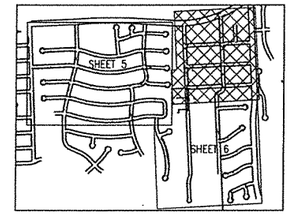
- EXISTING PIPE REDUCER
- BH01 — SOIL BORING W/BORE HOLE NUMBER
- FLOOD WAY
- 100YR FLOOD PLAN
- 500YR FLOOD PLAN



OVERALL LAYOUT MAP

Legend:

- Boring
- Boring with Piezometer

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KIT Professionals, Inc.
SRIKANTH PUNUKULA, P.E.
TEXAS REGISTRATION NO.: 88614
JUNE, 2013

DATE: JUNE 2013 CHECKED BY: SP
DESIGNED BY: YS DRAWN BY: JY/SS
SURVEYED BY: CIVILCORP
FB NO. X-XXXX

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

WATER LINE REPLACEMENT IN KICKERILLO AREA

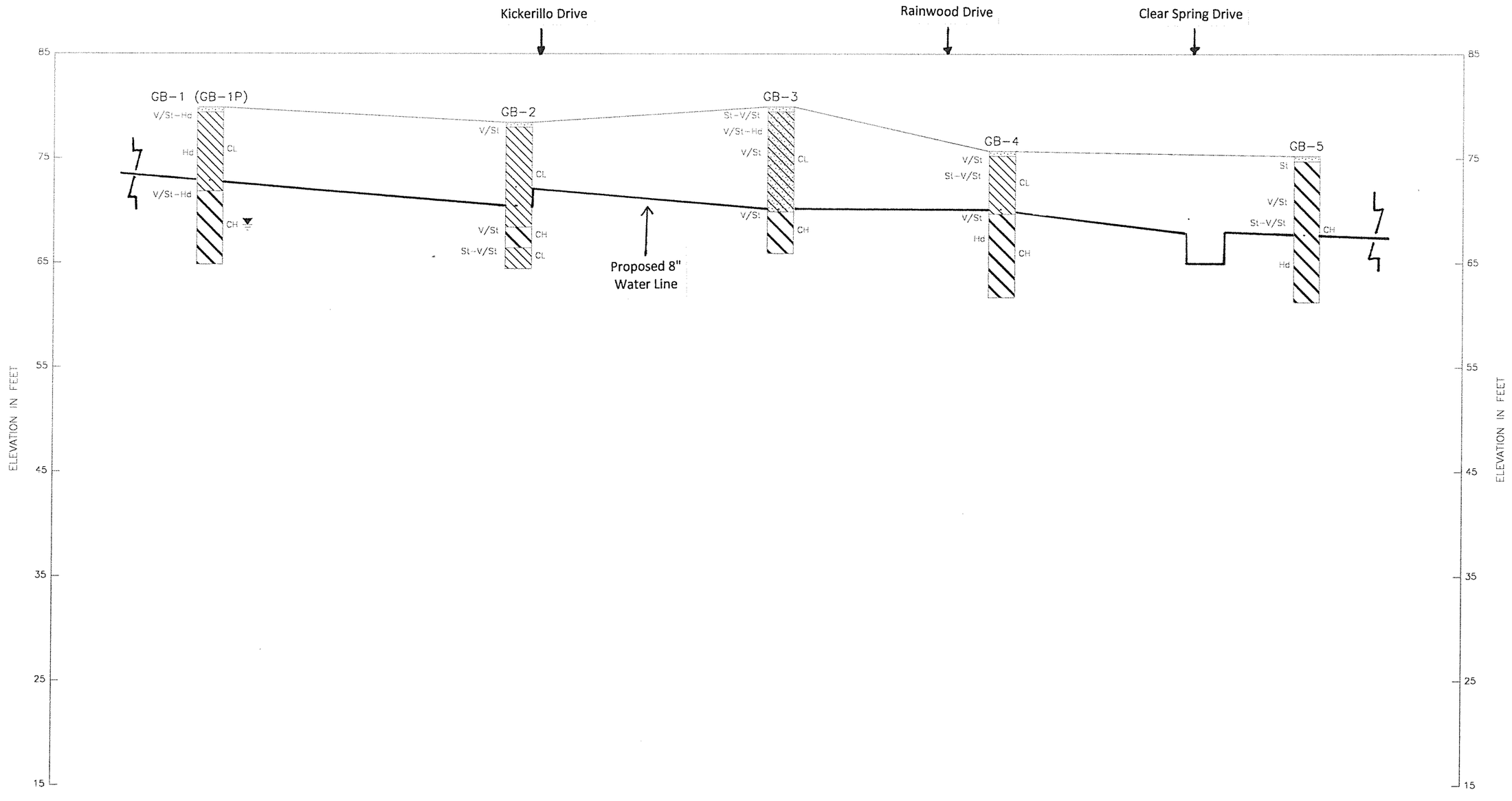
PLAN OF BORINGS

WBS NO. S-000035-0185-3	
DRAWING SCALE	
SCALE 1" = 200'	
CITY OF HOUSTON, PM	
VENUS NAHID P.E.	
SHEET NO. 7 OF 147	

R:\352 M&R\1101\PROD\3.2_CAD\3.2.2 General\Overall Layout.dwg

0 1 2 3 ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

FIGURE 2.3



GENERAL NOTES:

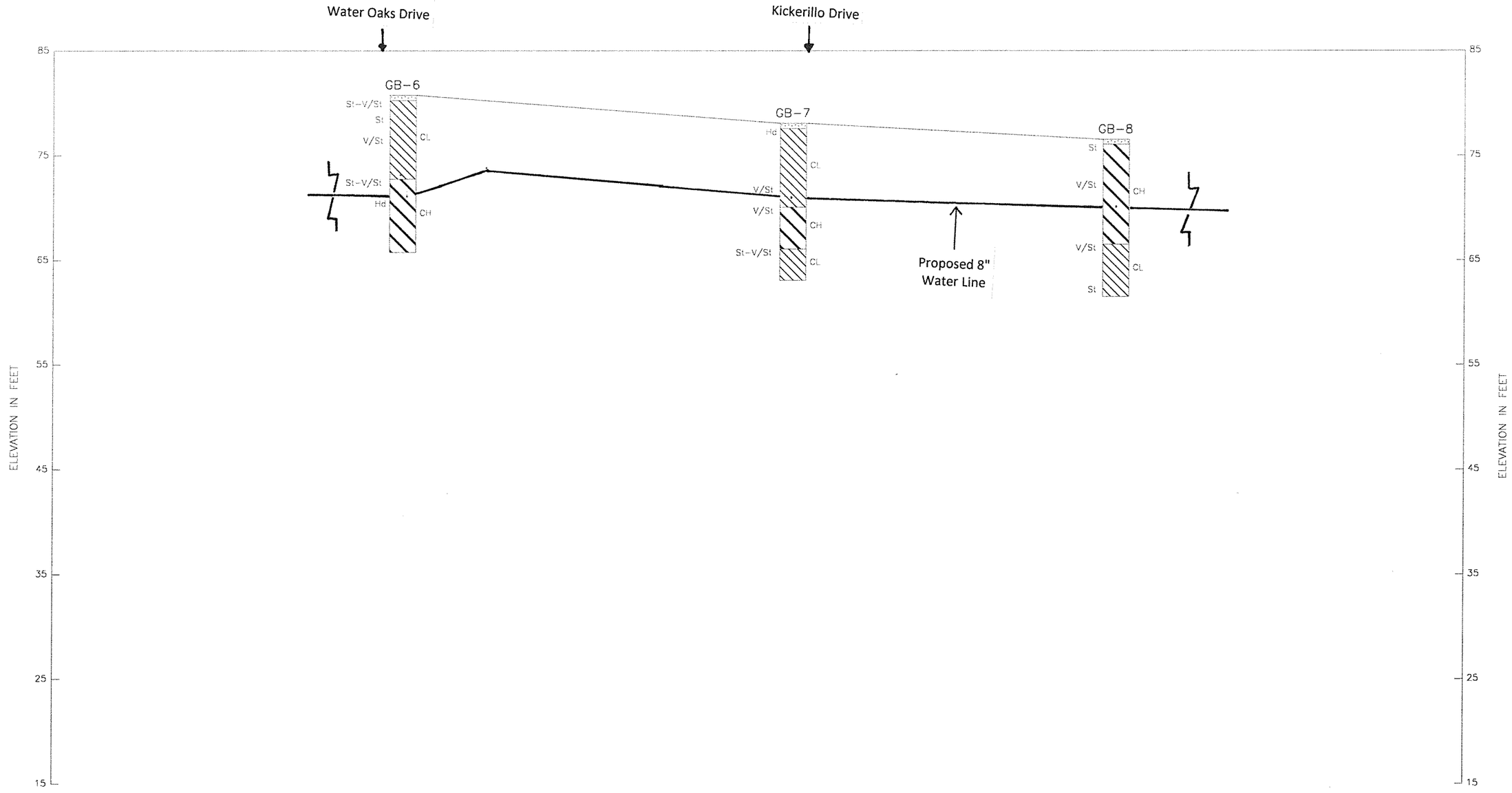
1. See Figure 2.1 for approximate location of borings and profile section.
2. Data concerning subsurface conditions have been obtained at boring locations only. Actual conditions between borings may differ from the profile shown here.
3. See logs of boring for detailed description of soils encountered in each borehole.
4. See Figure 4 for symbols and abbreviations used on this profile.
5. Ground surface elevation at each boring location was based on survey data provided to us by Jones and Carter, Inc.

BORING LOG PROFILE

Chadbourne Drive

0 100 200 300 400

HORIZONTAL SCALE IN FEET



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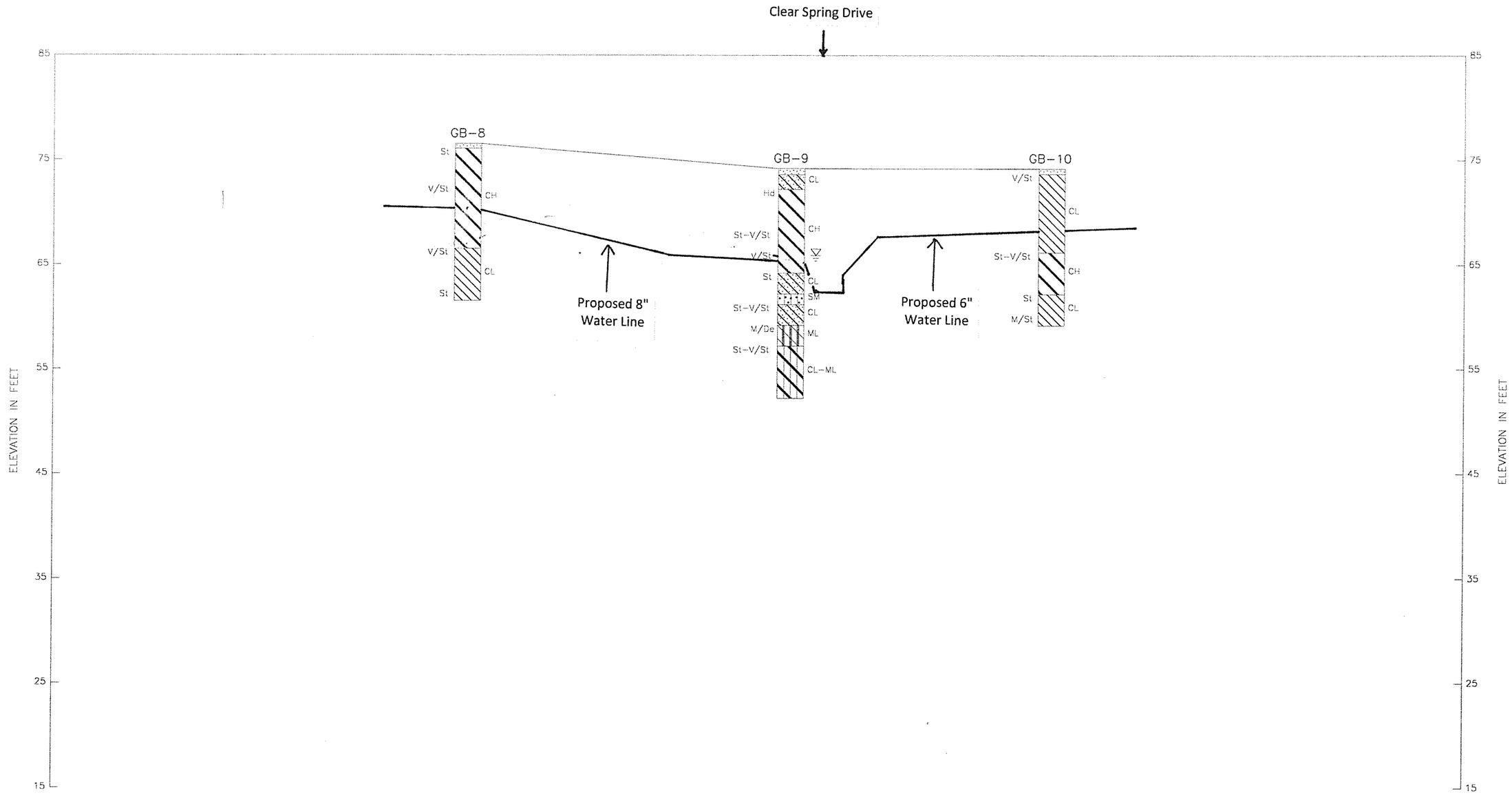
BORING LOG PROFILE

Broadgreen Drive

0 100 200 300 400

HORIZONTAL SCALE IN FEET



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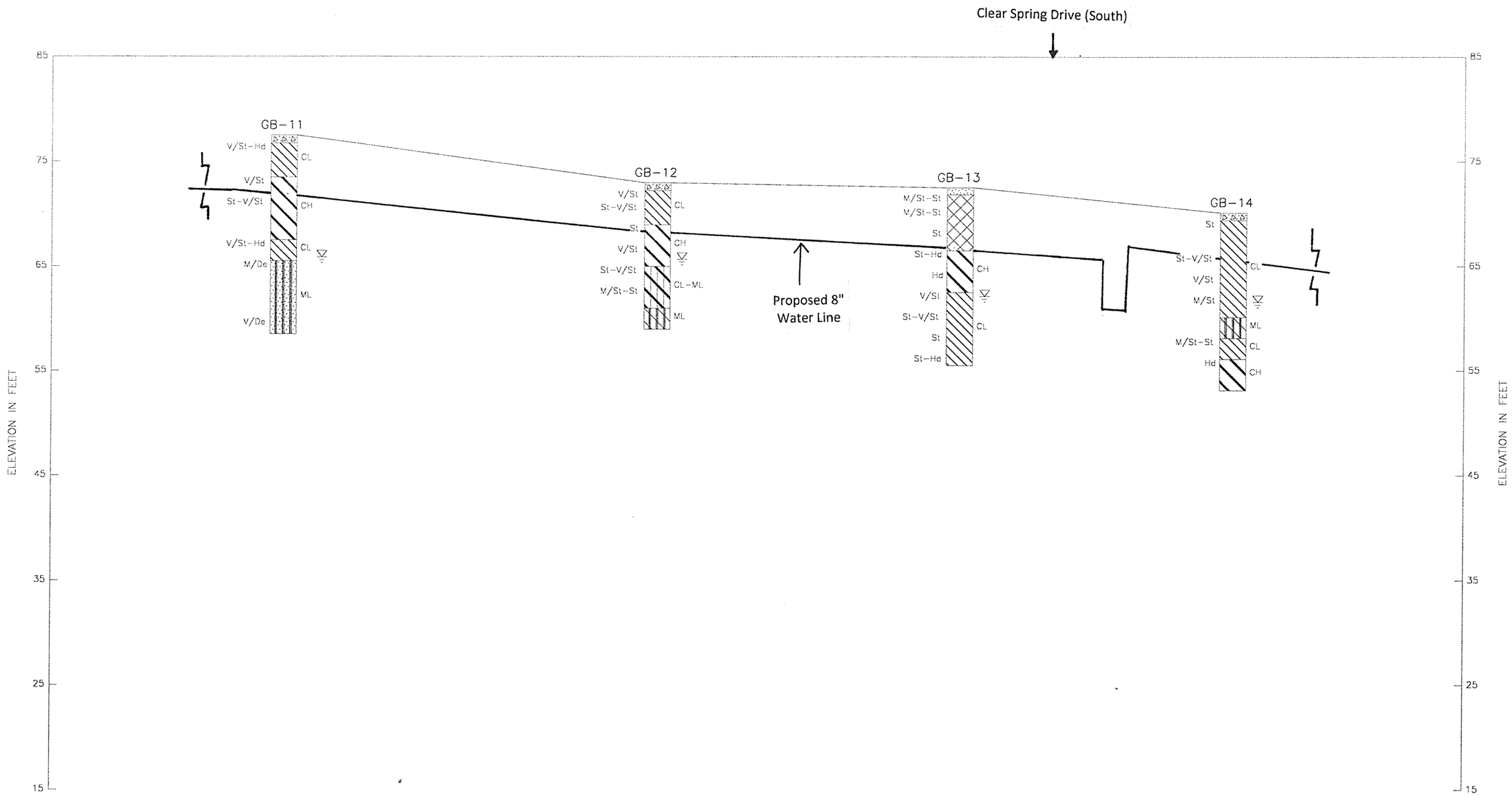
BORING LOG PROFILE

Broadgreen Drive

0 100 200 300 400

HORIZONTAL SCALE IN FEET



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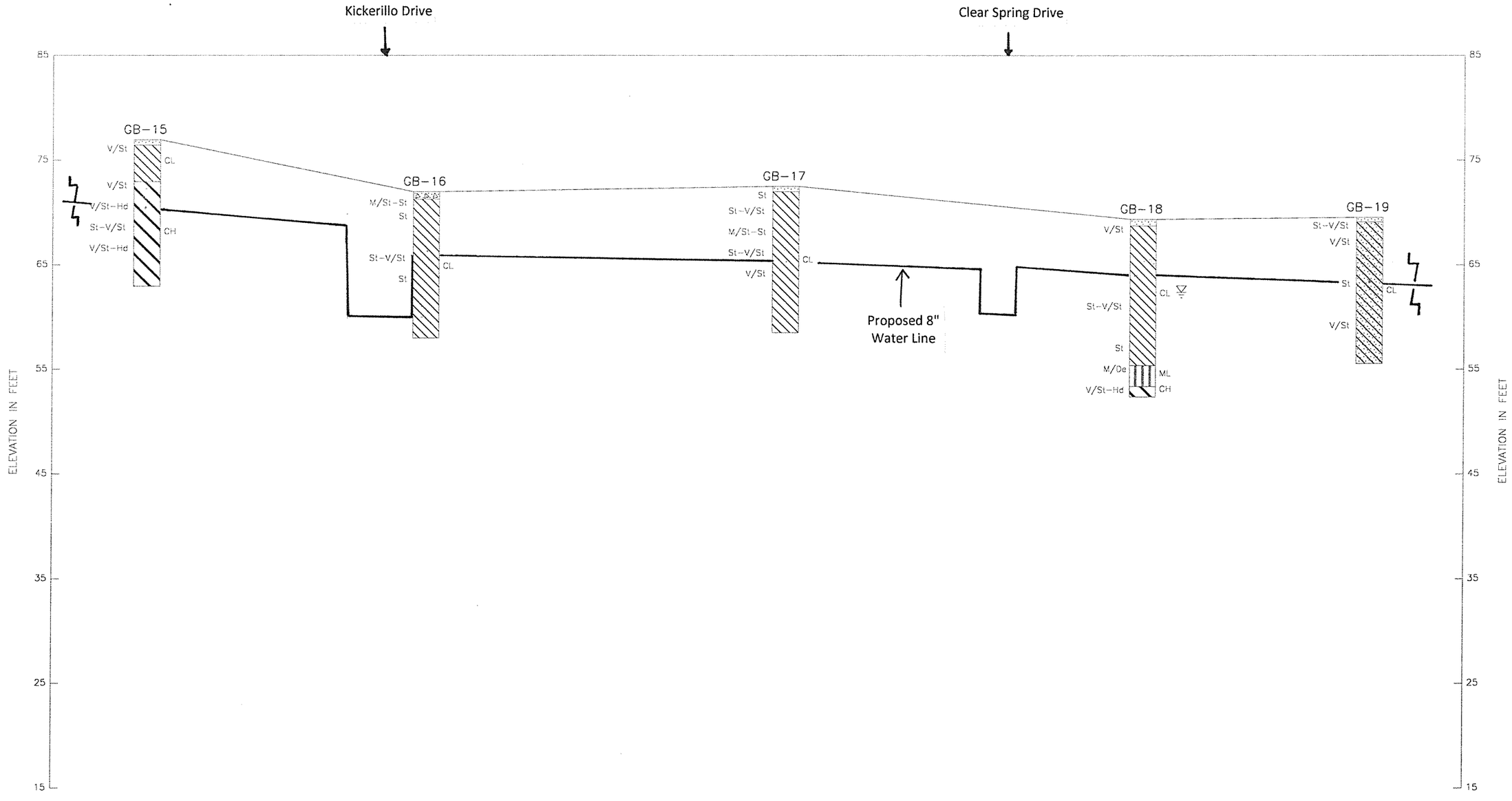
BORING LOG PROFILE

Cindywood Drive

0 100 200 300 400

HORIZONTAL SCALE IN FEET



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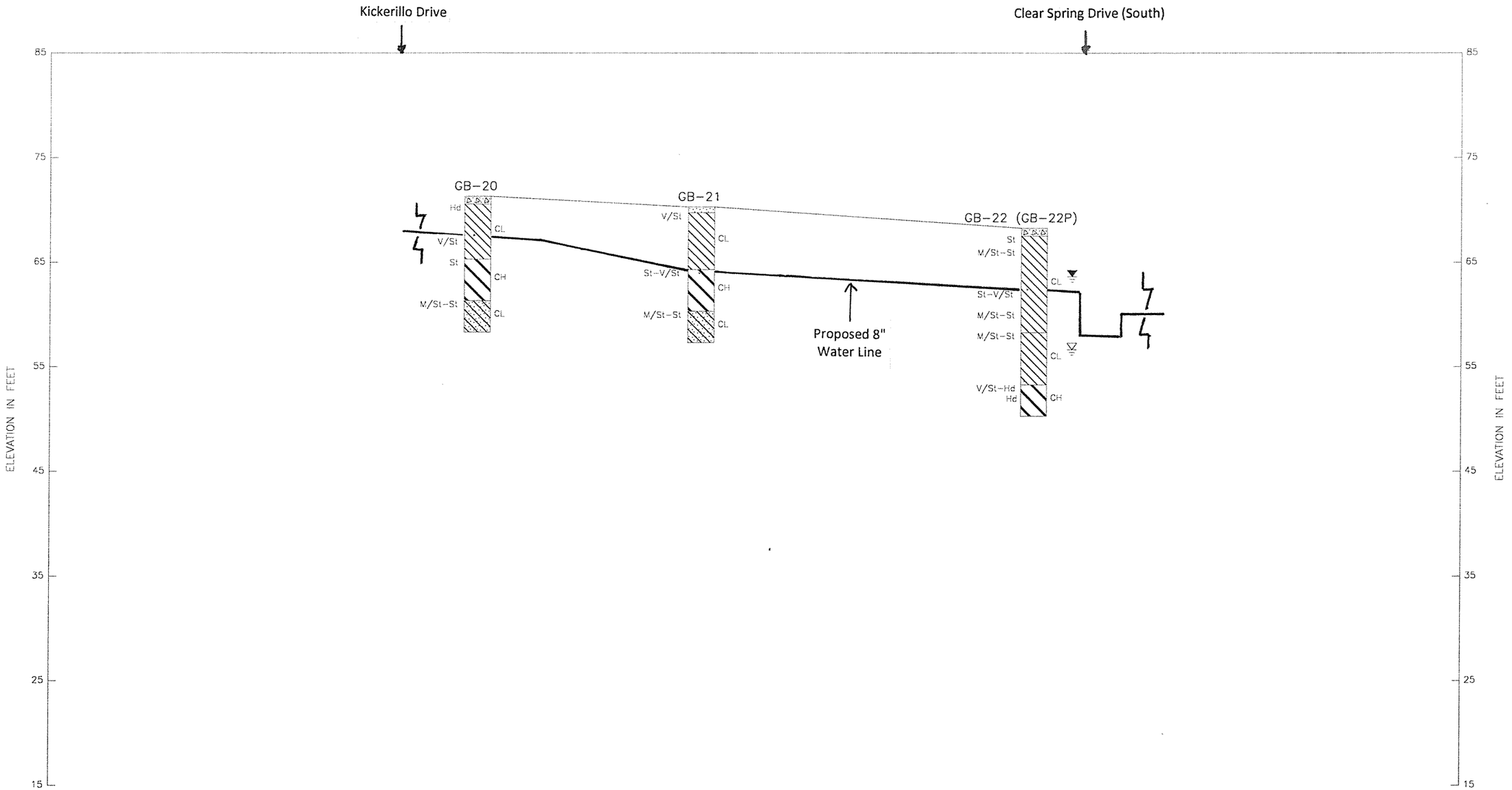
BORING LOG PROFILE

Carolcrest Drive

0 100 200 300 400

HORIZONTAL SCALE IN FEET



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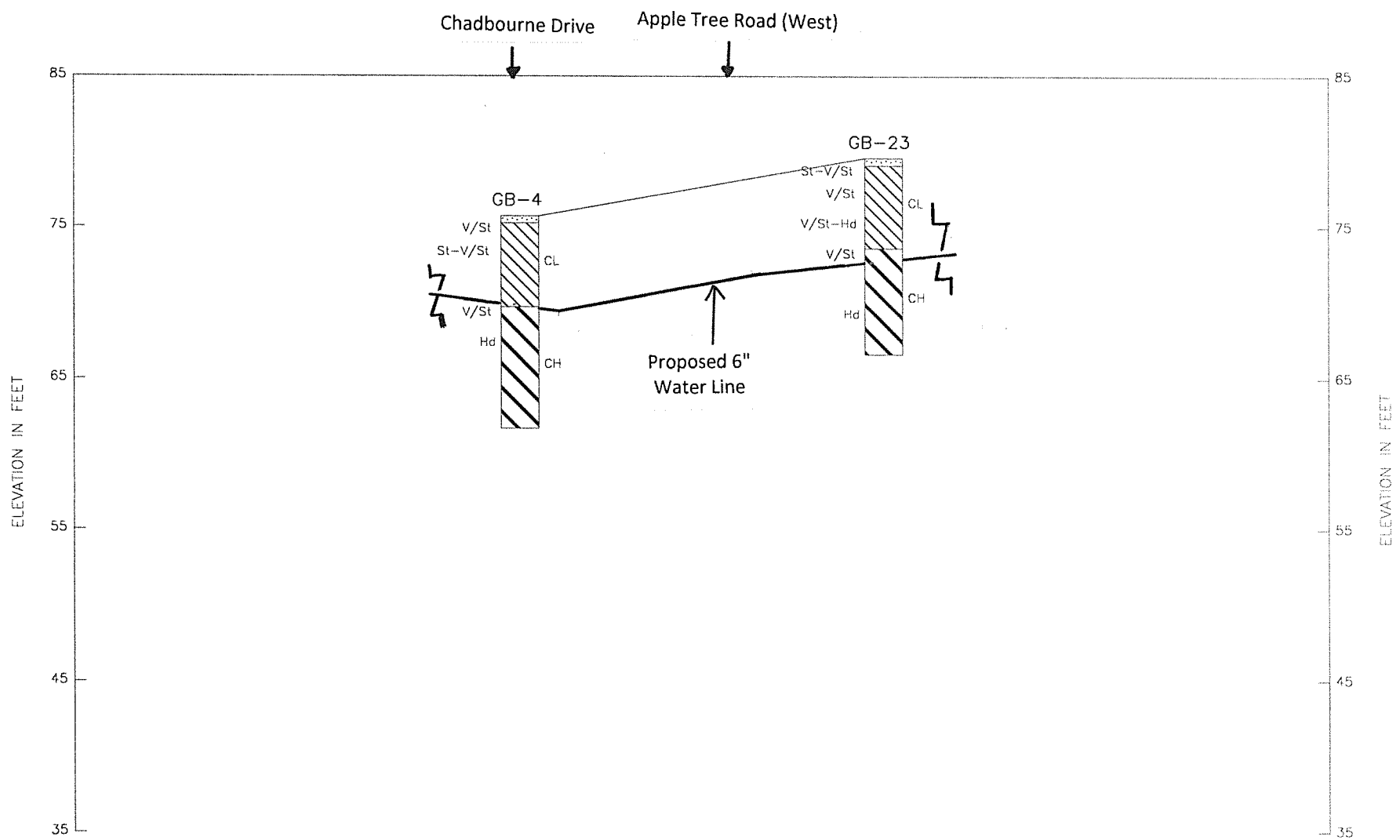
BORING LOG PROFILE

Kellywood Lane

0 100 200 300 400

HORIZONTAL SCALE IN FEET

Job No. 114019601



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BORING LOG PROFILE

Rainwood Drive

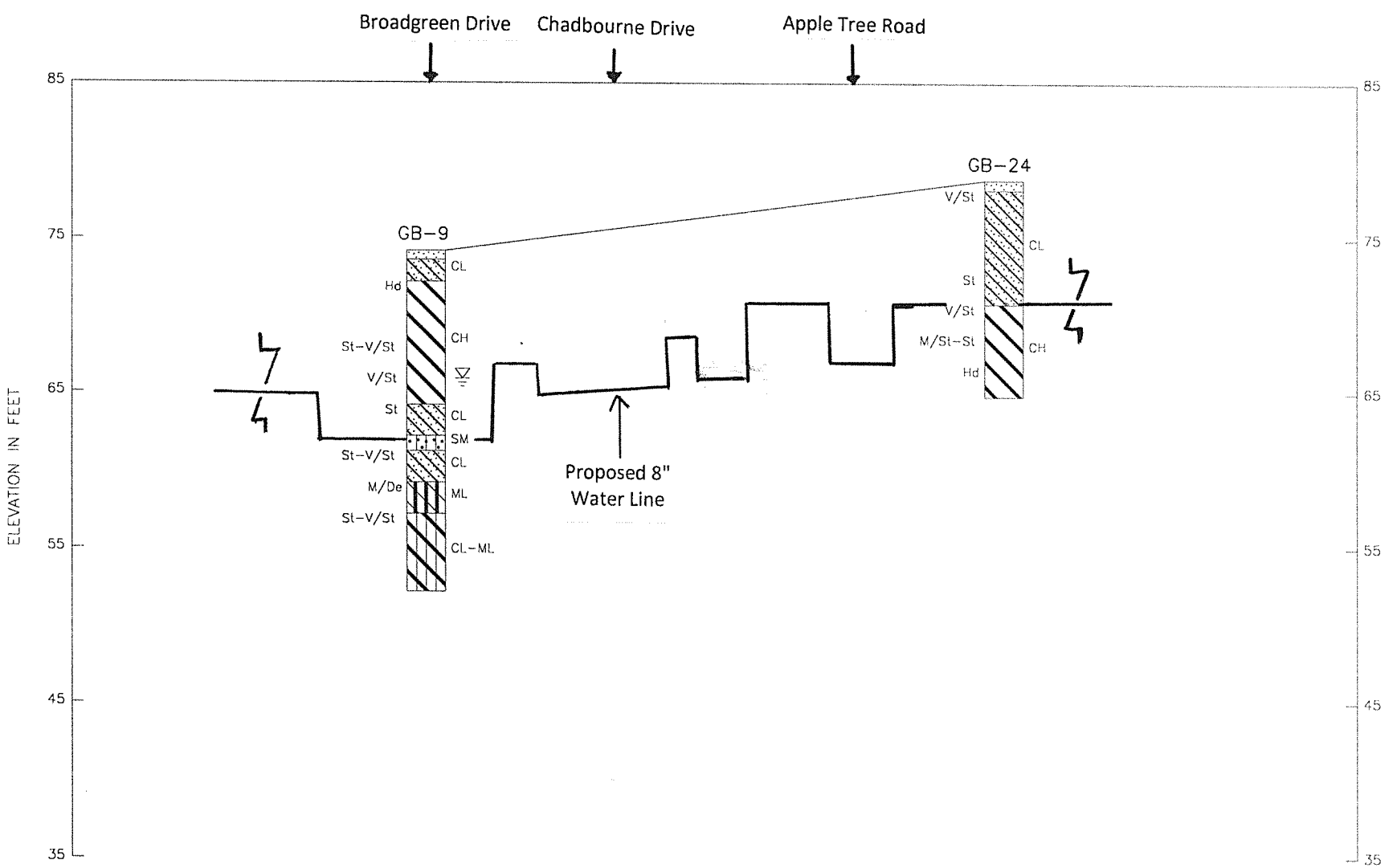
0 100 200 300 400

HORIZONTAL SCALE IN FEET

Geotest Engineering, Inc.

FIGURE 3.6

Job No. 114019601



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BORING LOG PROFILE

Clear Spring Drive

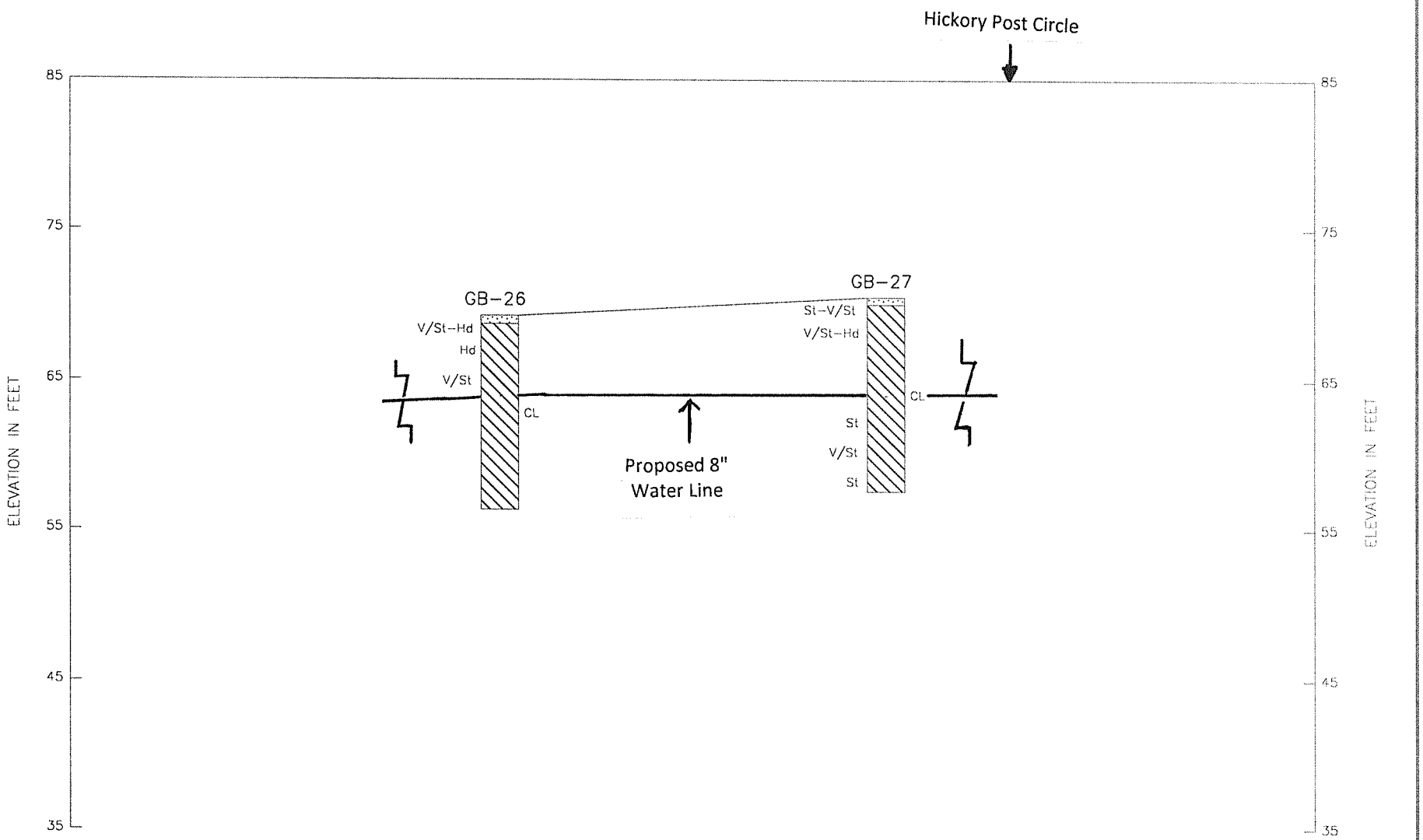
0 100 200 300 400

HORIZONTAL SCALE IN FEET

Geotest Engineering, Inc.

FIGURE 3.7

Job No. 1140194601



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4. See Figure 4 for symbols and obbreviations used on this profile.
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BORING LOG PROFILE

Hickory Post Lane

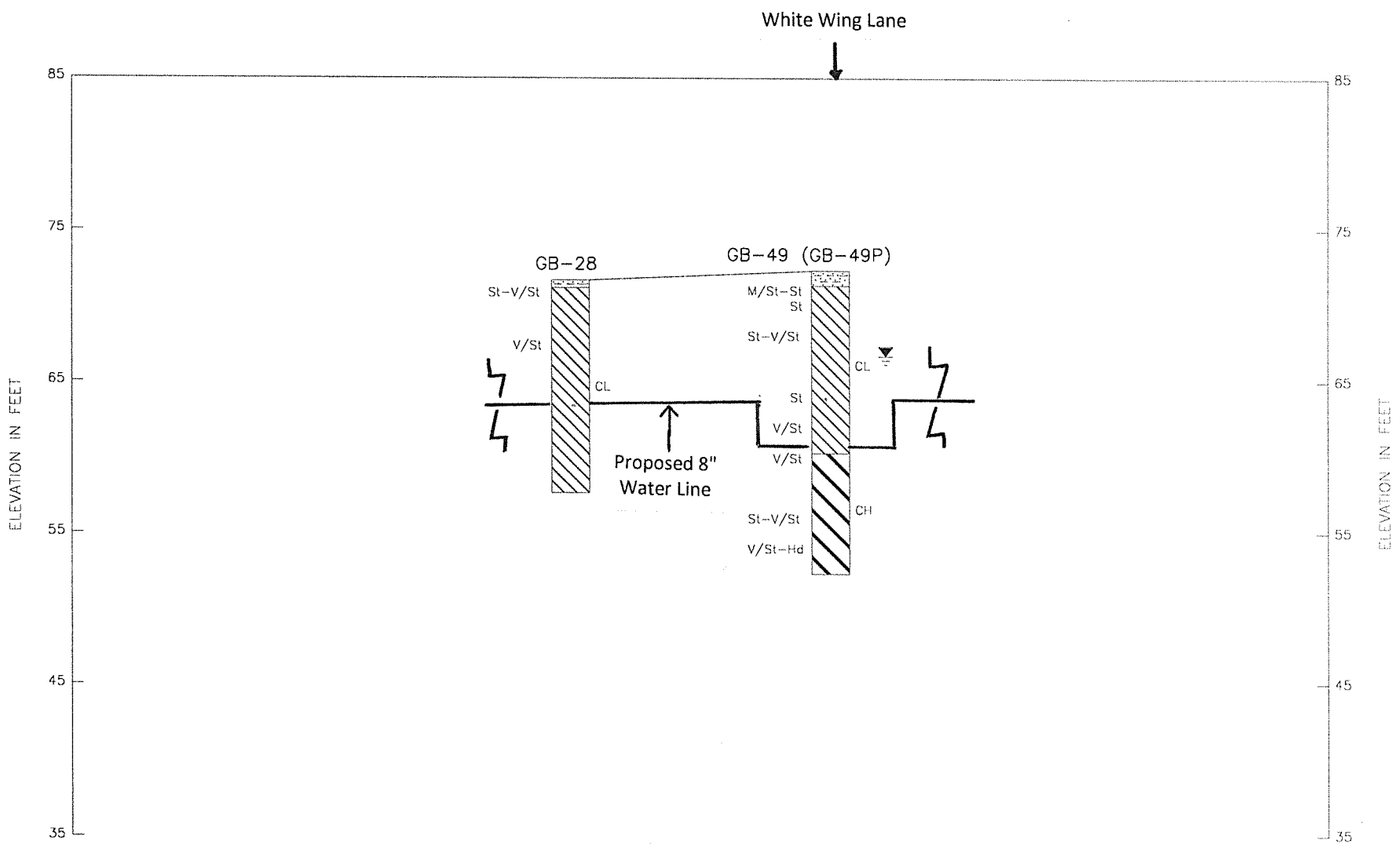
0 100 200 300 400

HORIZONTAL SCALE IN FEET

Geotest Engineering, Inc.

FIGURE 3.8

Job No. 1140194601



GENERAL NOTES:

1. See Figure 2.3 for approximate location of borings and profile section.
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BORING LOG PROFILE

Apple Tree Lane

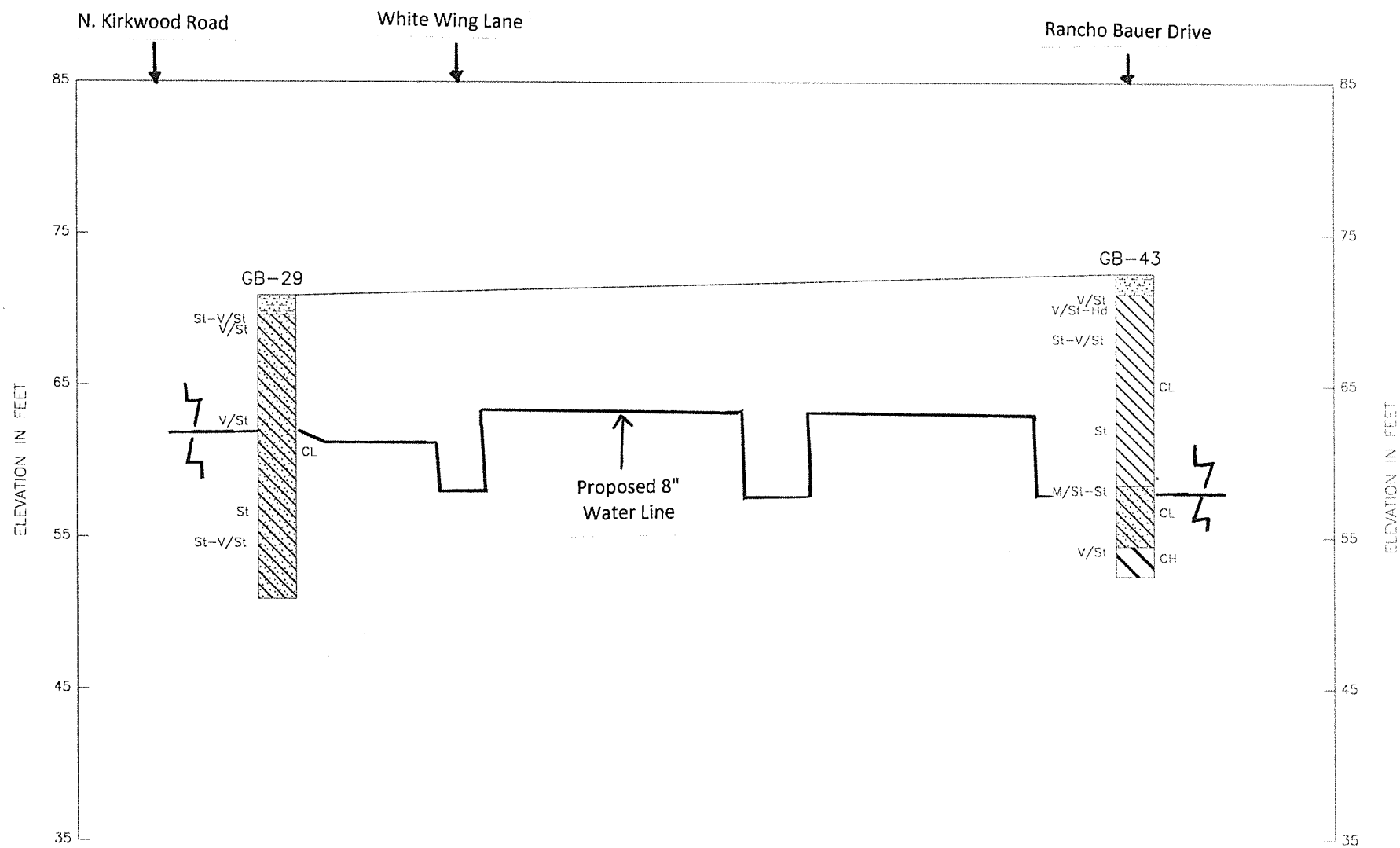
0 100 200 300 400

HORIZONTAL SCALE IN FEET

Geotest Engineering, Inc.

FIGURE 3.9

Job No. 1140194601



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BORING LOG PROFILE

Blue Bird Lane

0 100 200 300 400

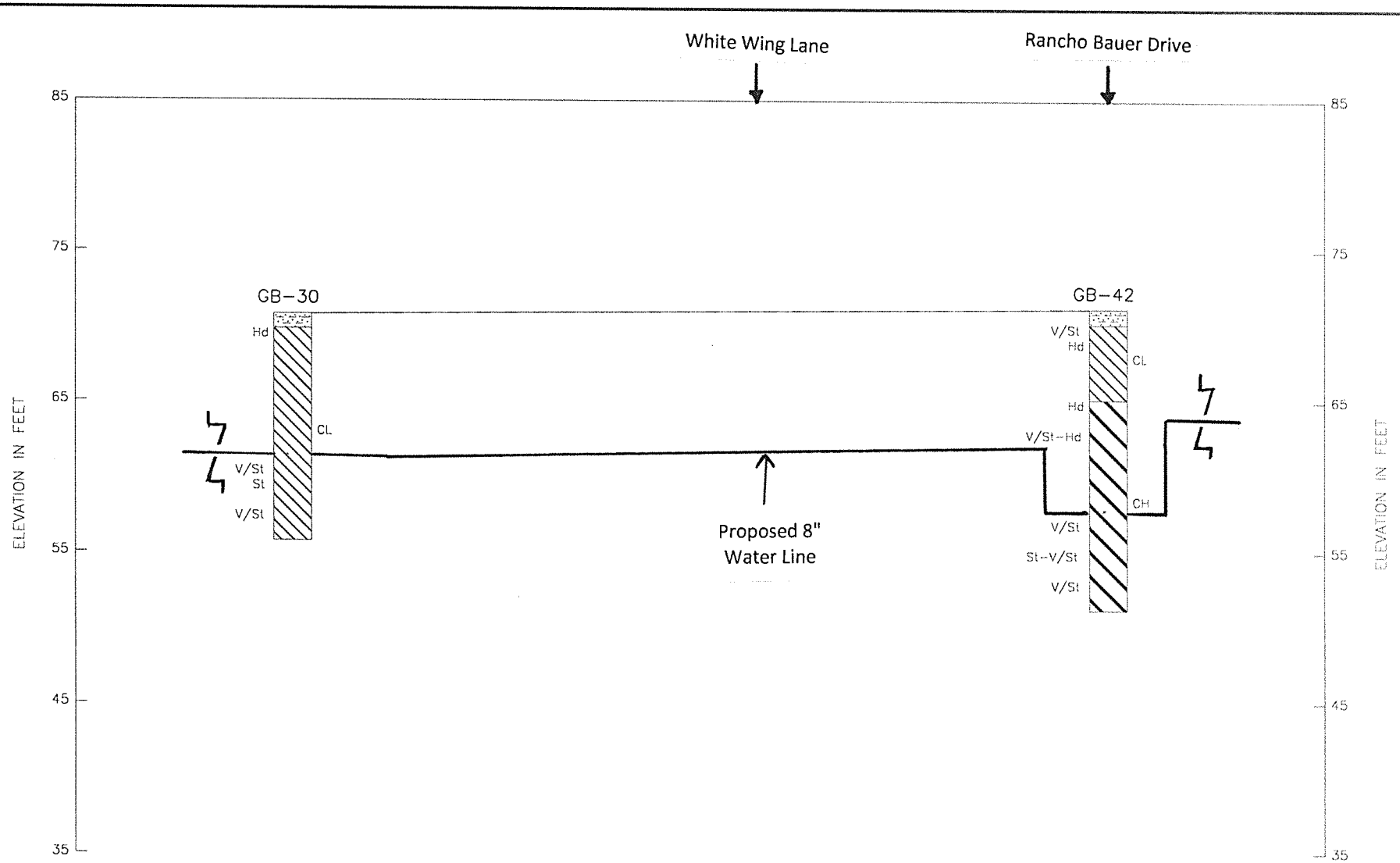
HORIZONTAL SCALE IN FEET

Geotest Engineering, Inc.

FIGURE 3.10

Job No. 114019601

Geotest Engineering, Inc.



GENERAL NOTES:

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BORING LOG PROFILE

Cardinal Lane

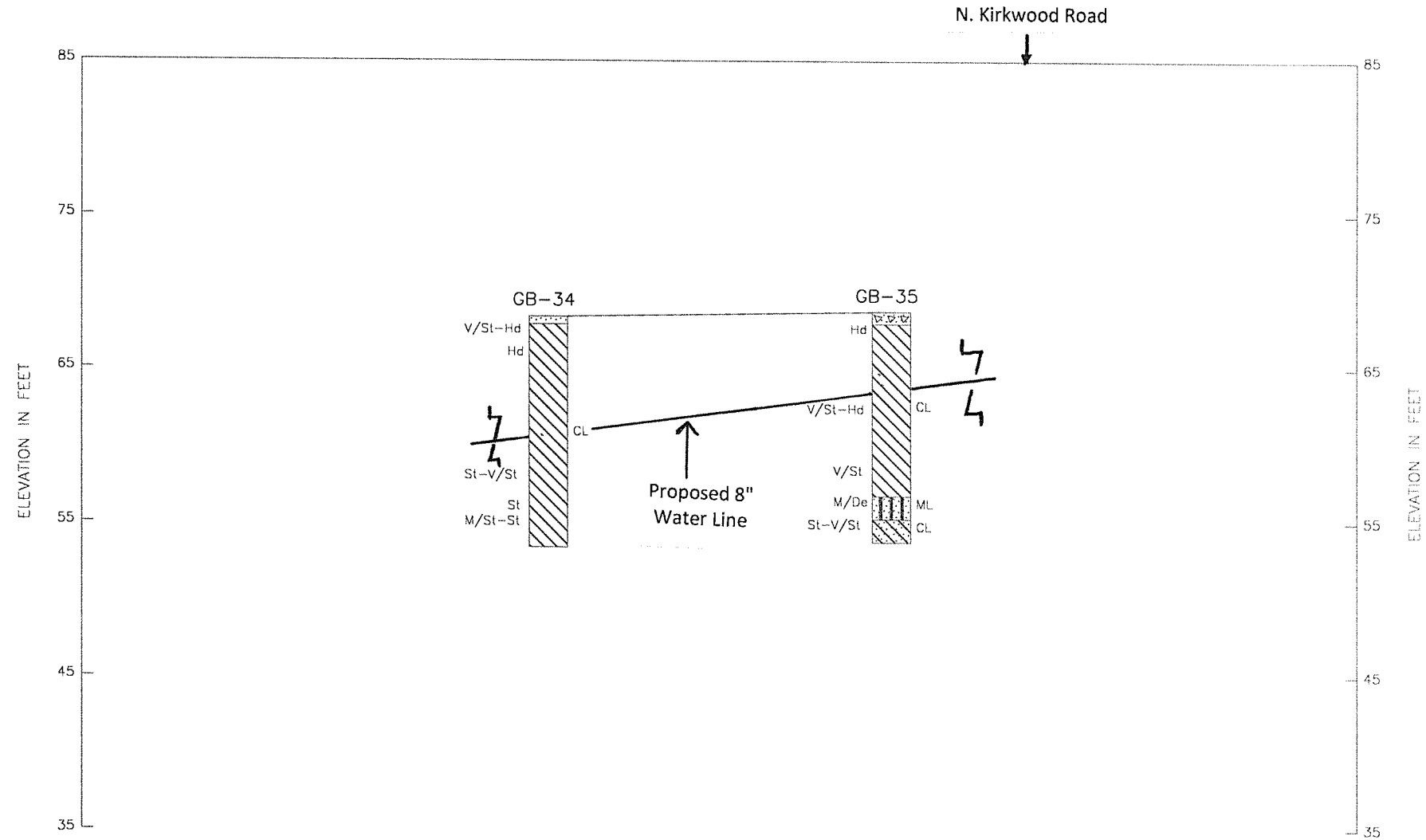
0 100 200 300 400

HORIZONTAL SCALE IN FEET

FIGURE 3.11

Job No. 1140194601

Geotest Engineering, Inc.



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BORING LOG PROFILE

River Forest Drive

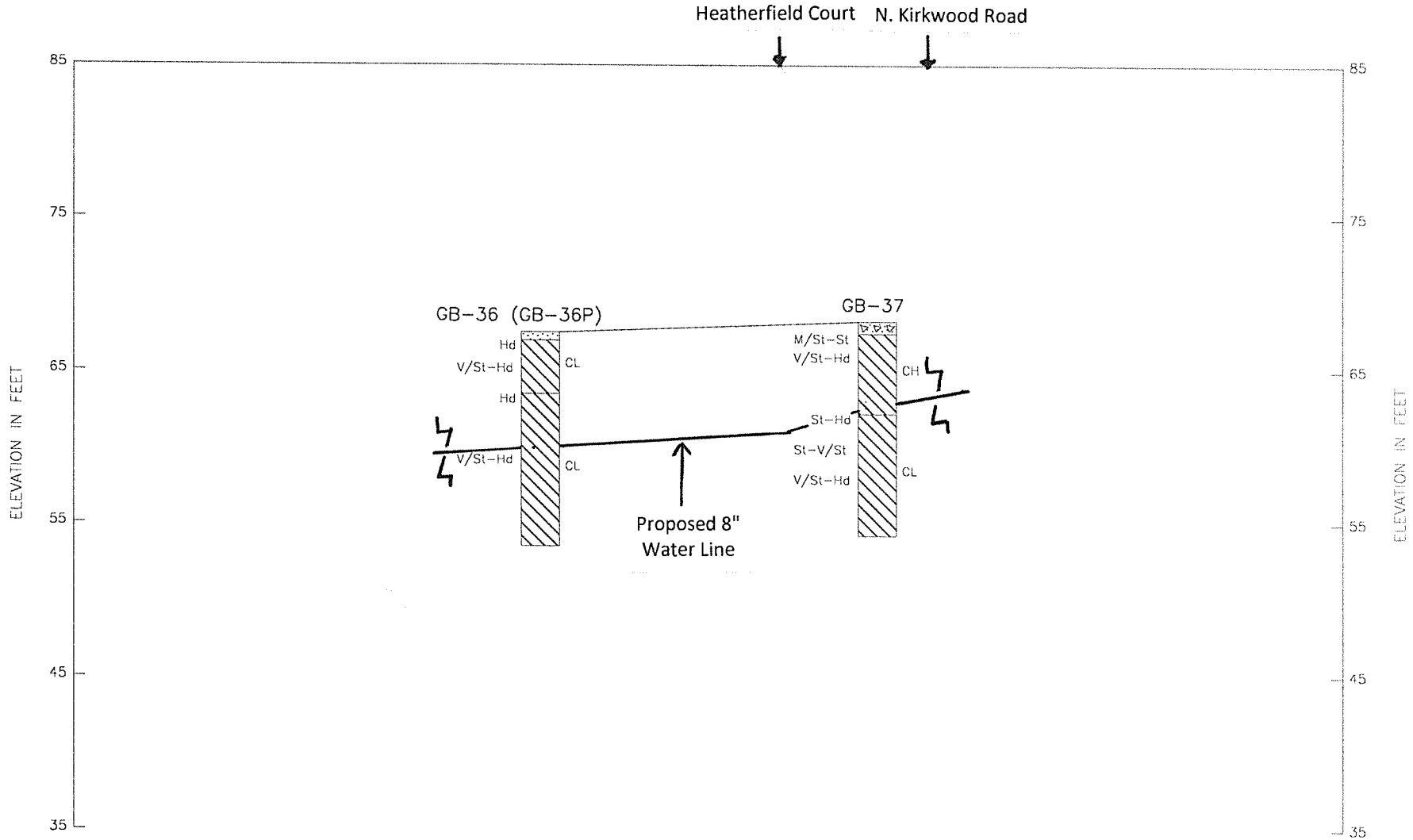
0 100 200 300 400

HORIZONTAL SCALE IN FEET

FIGURE 3.12

Job No. 1140194601

Geotest Engineering, Inc.



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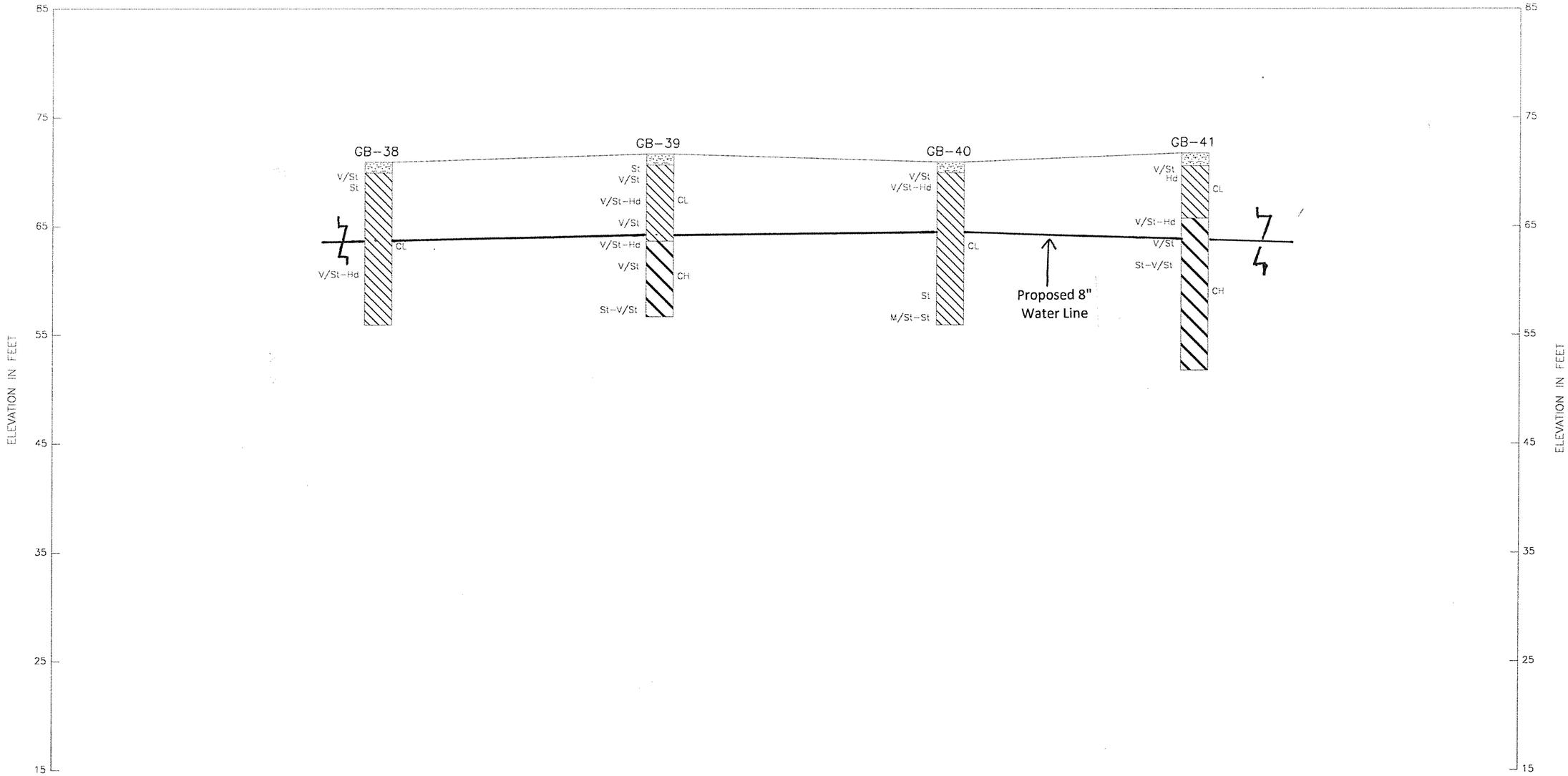
BORING LOG PROFILE

Heatherfield Drive

0 100 200 300 400

HORIZONTAL SCALE IN FEET

FIGURE 3.13



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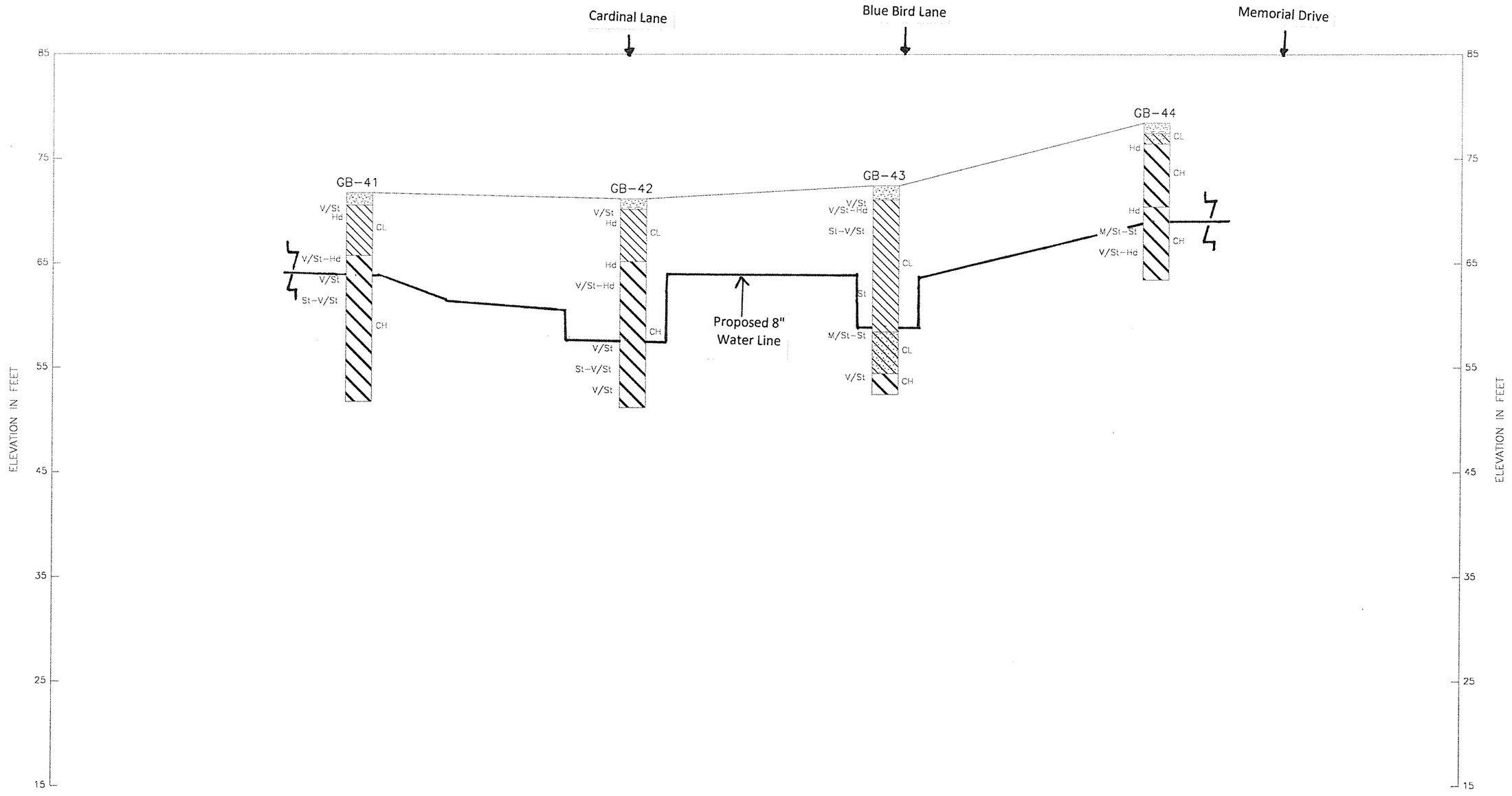
BORING LOG PROFILE

Rancho Bauer Drive

0 100 200 300 400

HORIZONTAL SCALE IN FEET



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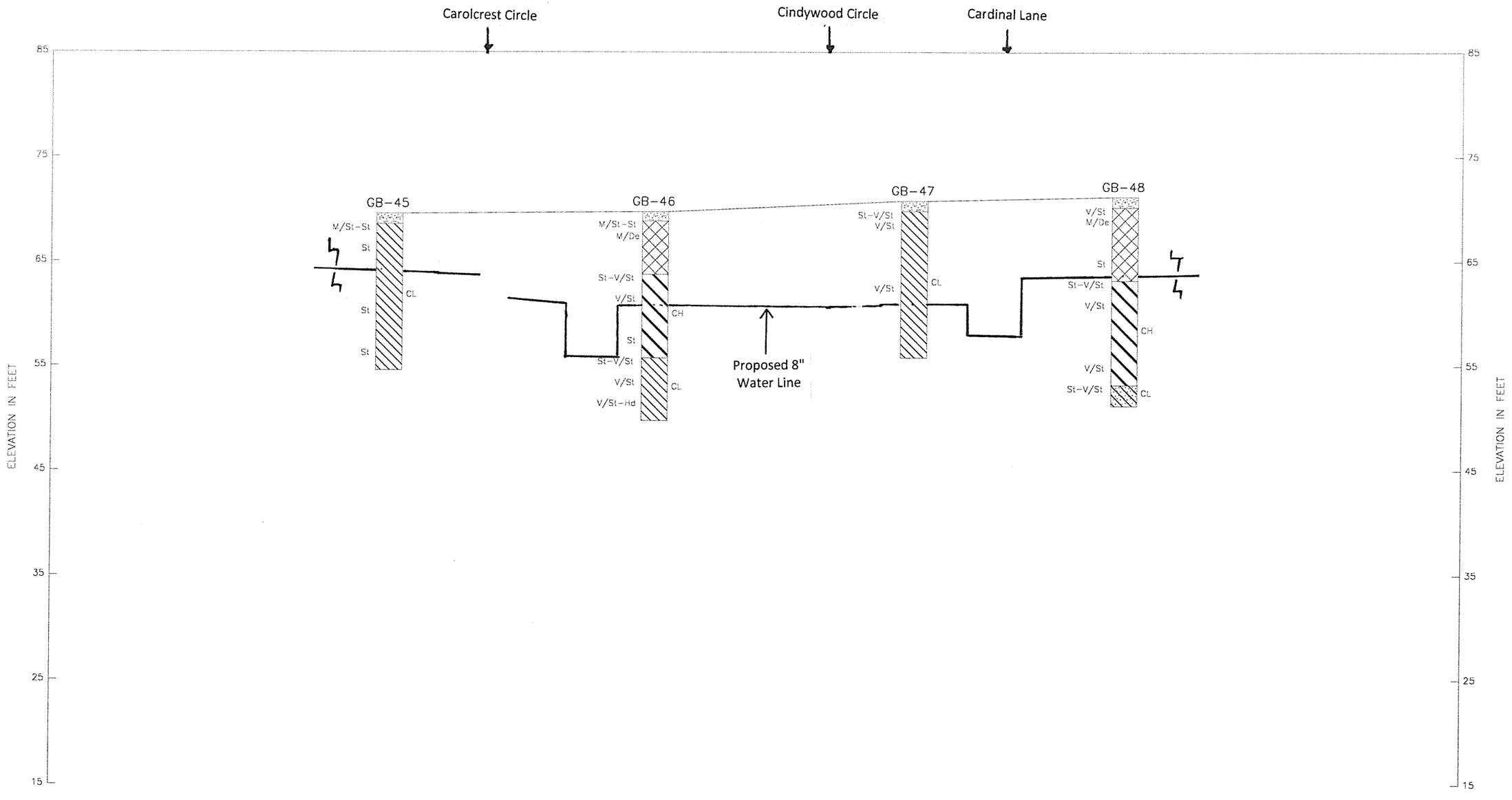
BORING LOG PROFILE

Rancho Bauer Drive

0 100 200 300 400

HORIZONTAL SCALE IN FEET



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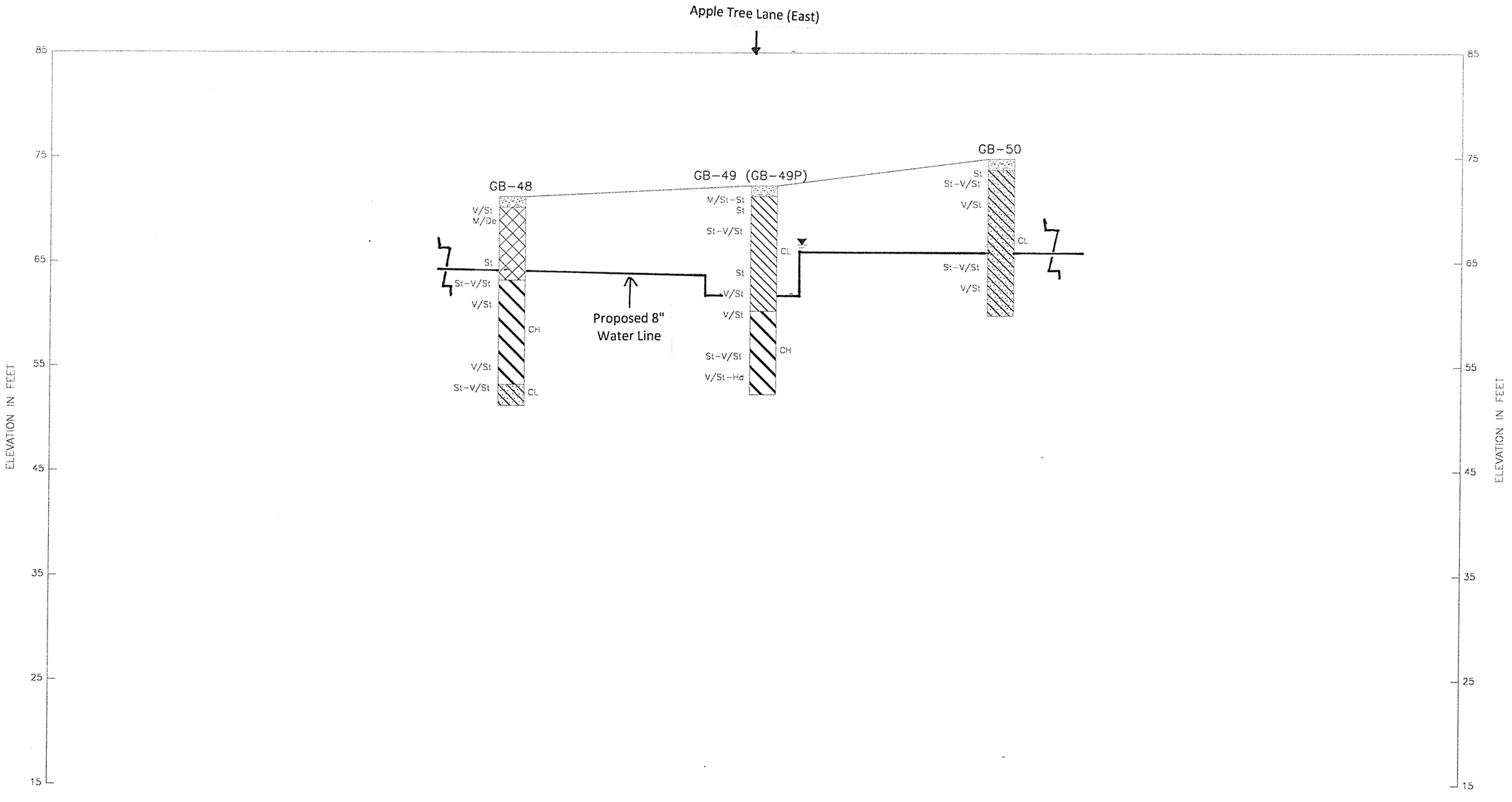
BORING LOG PROFILE

White Wing Lane

0 100 200 300 400

HORIZONTAL SCALE IN FEET



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BORING LOG PROFILE

White Wing Lane

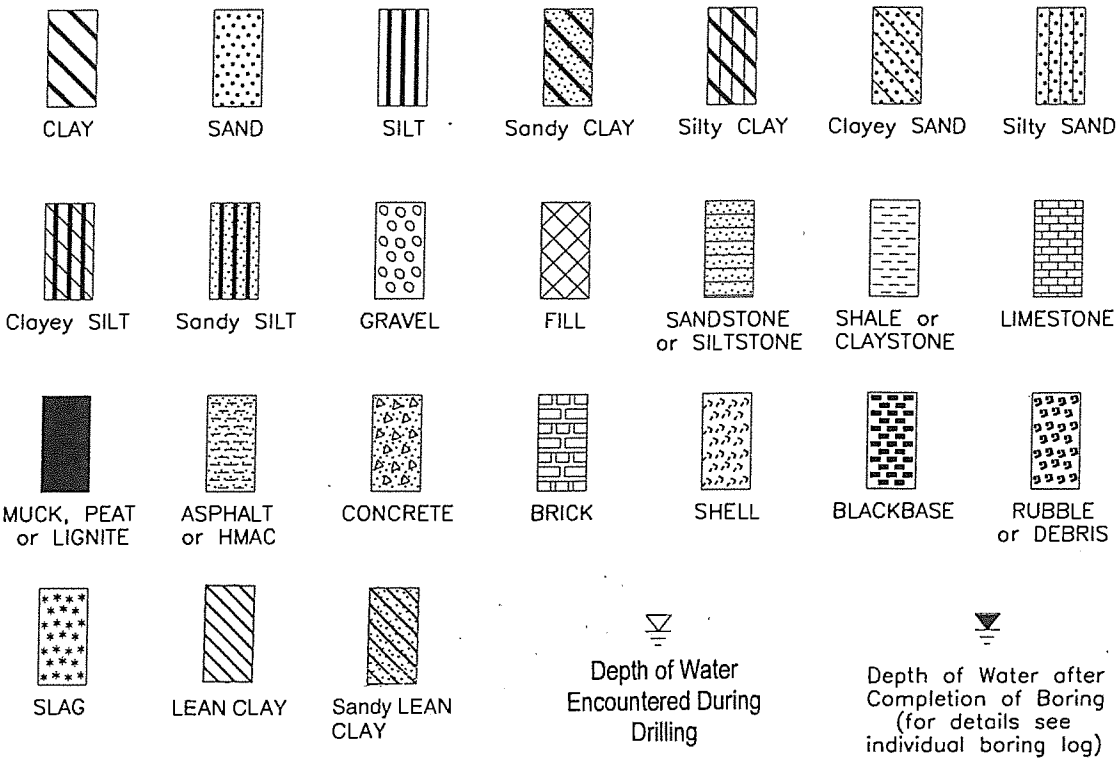
0 100 200 300 400

HORIZONTAL SCALE IN FEET

Job No. 1140194601

SYMBOLS AND ABBREVIATIONS USED ON BORING LOG PROFILE

LEGEND



ABBREVIATIONS USED FOR CONSISTENCY/DENSITY

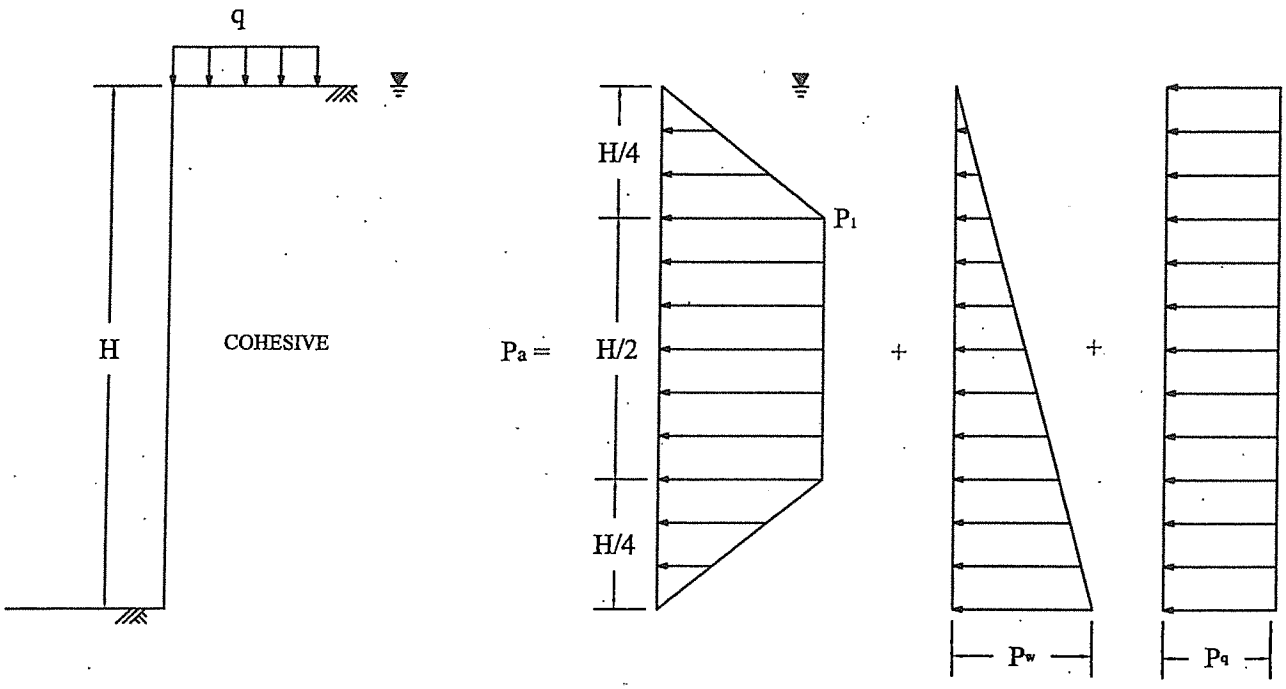
COHESIVE SOILS

V/So	:	Very Soft
So	:	Soft
Fm	:	Firm
M/St	:	Medium Stiff
St	:	Stiff
V/St	:	Very Stiff
Hd	:	Hard
V/Hd	:	Very Hard

COHESIONLESS SOILS

V/Lo	:	Very Loose
Lo	:	Loose
S/Co	:	Slightly Compact
Co	:	Compact
M/De	:	Medium Dense
De	:	Dense
V/De	:	Very Dense

Job No. 1140194601



TYPICAL SOIL PARAMETERS

See Table 2 for typical values of soil parameters

BRACED WALL

For $\gamma H/c \leq 4$

$P_1 = 0.3\ \gamma_c' H$
$P_w = \gamma_w H = 62.4 H$
$P_q = 0.5\ q$

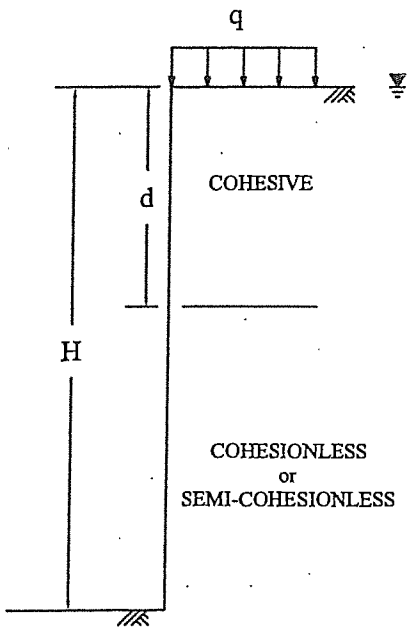
Where:

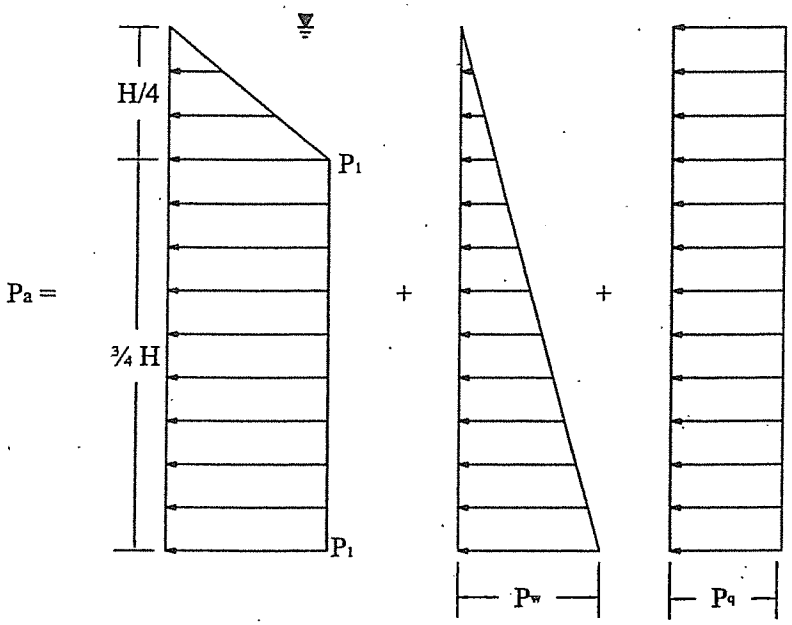
γ_c' = Submerged unit weight of cohesive soil, pcf;
γ_w = Unit weight of water, pcf;
q = Surcharge load at surface, psf;
P_a = Lateral pressure, psf;
P_1 = Active earth pressure, psf;
P_q = Horizontal pressure due to surcharge, psf;
P_w = Hydrostatic pressure due to groundwater, psf;
H = Depth of braced excavation, feet
c = Shear strength of cohesion soil, psf;

TRENCH SUPPORT EARTH PRESSURE

SUBMERGED COHESIVE SOIL

Job No. 1140194601





TYPICAL SOIL PARAMETERS

BRACED WALL

See Table 2 for typical values of soil parameters

$$\gamma'_{avg} = \frac{\gamma_c' d + \gamma_s' (H-d)}{H}$$

$P_1 = 0.3\ \gamma'_{avg} H$
$P_w = 62.4\ H$
$P_q = 0.5\ q$

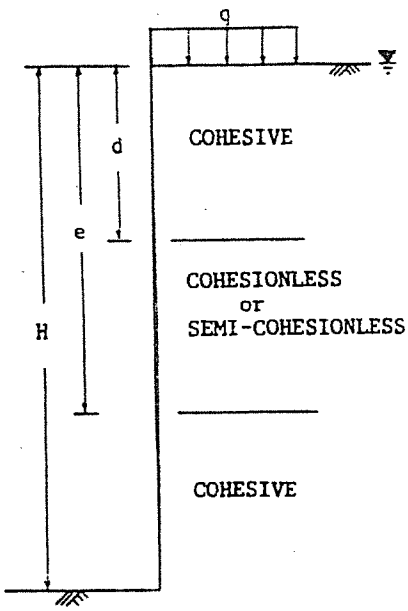
Where:

γ_c' = Submerged unit weight of cohesive soil, pcf;
γ_s' = Submerged unit weight of cohesionless soil, pcf;
γ'_{avg} = Average submerged unit weight of soils, pcf;
q = Surcharge load at surface, psf;
P_a = Lateral pressure, psf;
P_1 = Active earth pressure, psf;
P_q = Horizontal pressure due to surcharge, psf;
P_w = Hydrostatic pressure due to groundwater, psf;
H = Depth of braced excavation, feet

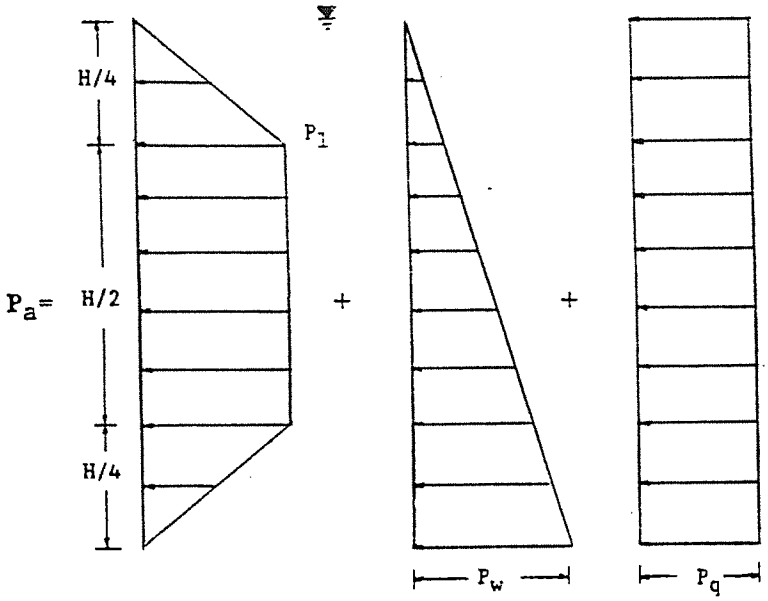
TRENCH SUPPORT EARTH PRESSURE

SUBMERGED COHESIVE SOIL OVER
COHESIONLESS OR SEMI-COHESIONLESS SOIL

Job No. 1140194601



TYPICAL SOIL PARAMETERS



BRACED WALL

See Table 2 for typical values of soil parameters

$$P_1 = 0.3\ \gamma'_{avg}\ H$$

$$P_w = \gamma_w\ H = 62.4\ H$$

$$P_q = 0.5q$$

$$\gamma'_{avg} = \frac{\gamma_c'\ d + \gamma_s'\ (e-d) + \gamma_c'\ (H-e)}{H}$$

$$\gamma_w = 62.4\ pcf$$

Where:

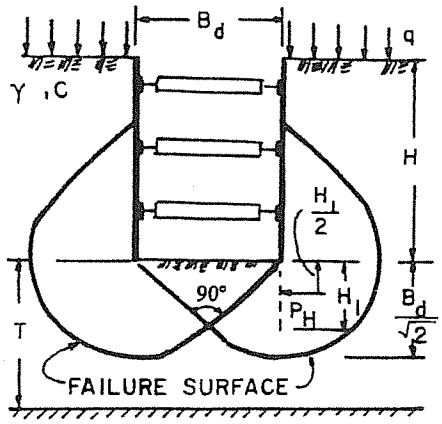
- γ_c' = Submerged unit weight of cohesive soil, pcf ;
- γ_s' = Submerged unit weight of cohesionless or semi-cohesionless soil, pcf ;
- γ_w = Unit weight of water, pcf;
- γ'_{avg} = Average submerged unit weight of soil, pcf ;
- q = Surcharge load at surface, psf;
- P_a = Lateral pressure, psf;
- P_1 = Active earth pressure, psf;
- P_q = Horizontal pressure due to surcharge, psf;
- P_w = Hydrostatic pressure due to groundwater, psf;
- H = Depth of braced excavation, feet

TRENCH SUPPORT EARTH PRESSURE

SUBMERGED COHESIVE SOIL INTERBEDDED WITH COHESIONLESS OR SEMI-COHESIONLESS SOIL

Job No. 1140194601

CUT IN COHESIVE SOIL,
DEPTH OF COHESIVE SOIL UNLIMITED ($T > 0.7\ B_d$)
L = LENGTH OF CUT



If sheeting terminates at base of cut:

$$\text{Safety factor, } F_S = \frac{N_C C}{\gamma H + q}$$

N_C = Bearing capacity factor, which depends on dimensions of the excavation : B_d , L and H (use N_C from graph below)

C = Undrained shear strength of clay in failure zone beneath and surrounding base of cut

γ = Wet unit weight of soil (see Table 2)

q = Surface surcharge (assume q = 500 psf)

If safety factor is less than 1.5, sheeting or soldier piles must be carried below the base of cut to insure stability - (see note)

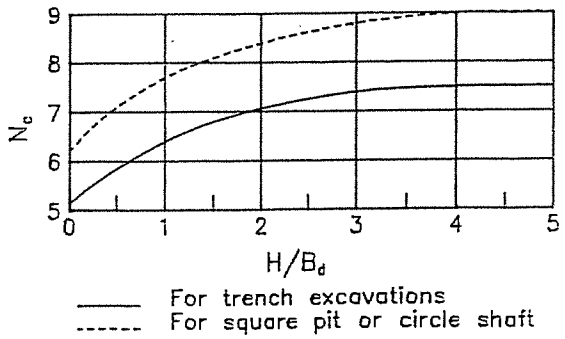
H_1 = Buried length $= \frac{B_d}{2} \geq 5$ feet

Note : If soldier piles are used, the center to center spacing should not exceed 3 times the width or diameter of soldier pile .

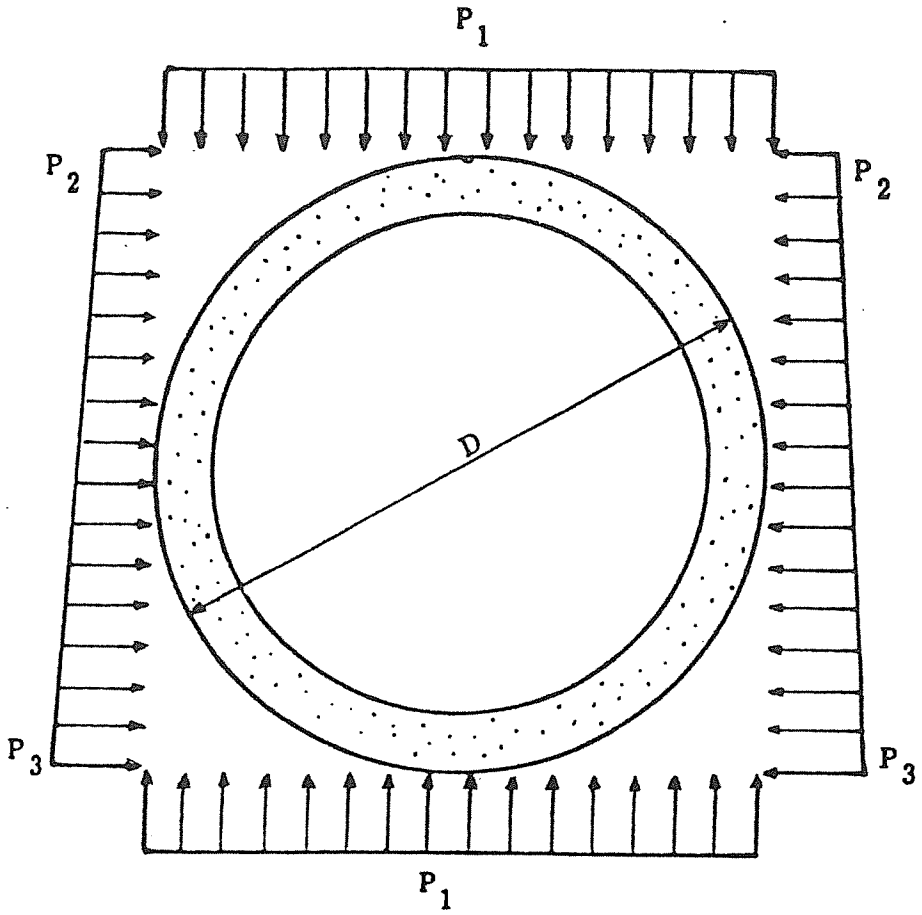
Force on buried length, P_H:

If $H_1 > \frac{2}{3}\frac{B_d}{\sqrt{2}}$, $P_H = 0.7\ (\gamma\ HB_d - 1.4CH - \pi CB_d)$ in lbs/ linear foot

If $H_1 < \frac{2}{3}\frac{B_d}{\sqrt{2}}$, $P_H = 1.5H_1\ (\gamma\ H - \frac{1.4CH}{B_d} - \pi C)$ in lbs/ linear foot



STABILITY OF BOTTOM
FOR
BRACED CUT



$$P_1 = [(H + \frac{D}{2}) \times (\gamma - \gamma_w) + D_w \times \gamma_w] + q_s \text{ , for } D_w < H + \frac{D}{2}$$

$$P_1 = [(H + \frac{D}{2}) \times \gamma] + q_s \text{ , for } D_w \geq H + \frac{D}{2}$$

$$P_2 = (H \times \gamma) + q_s$$

$$P_3 = [(H + D) \times \gamma] + q_s$$

Where: P_1, P_2, P_3 = Tunnel liner load, psf.

D = Tunnel outside diameter, ft.

H = Depth to top of tunnel; ft.

D_w = Depth to ground water level; ft.

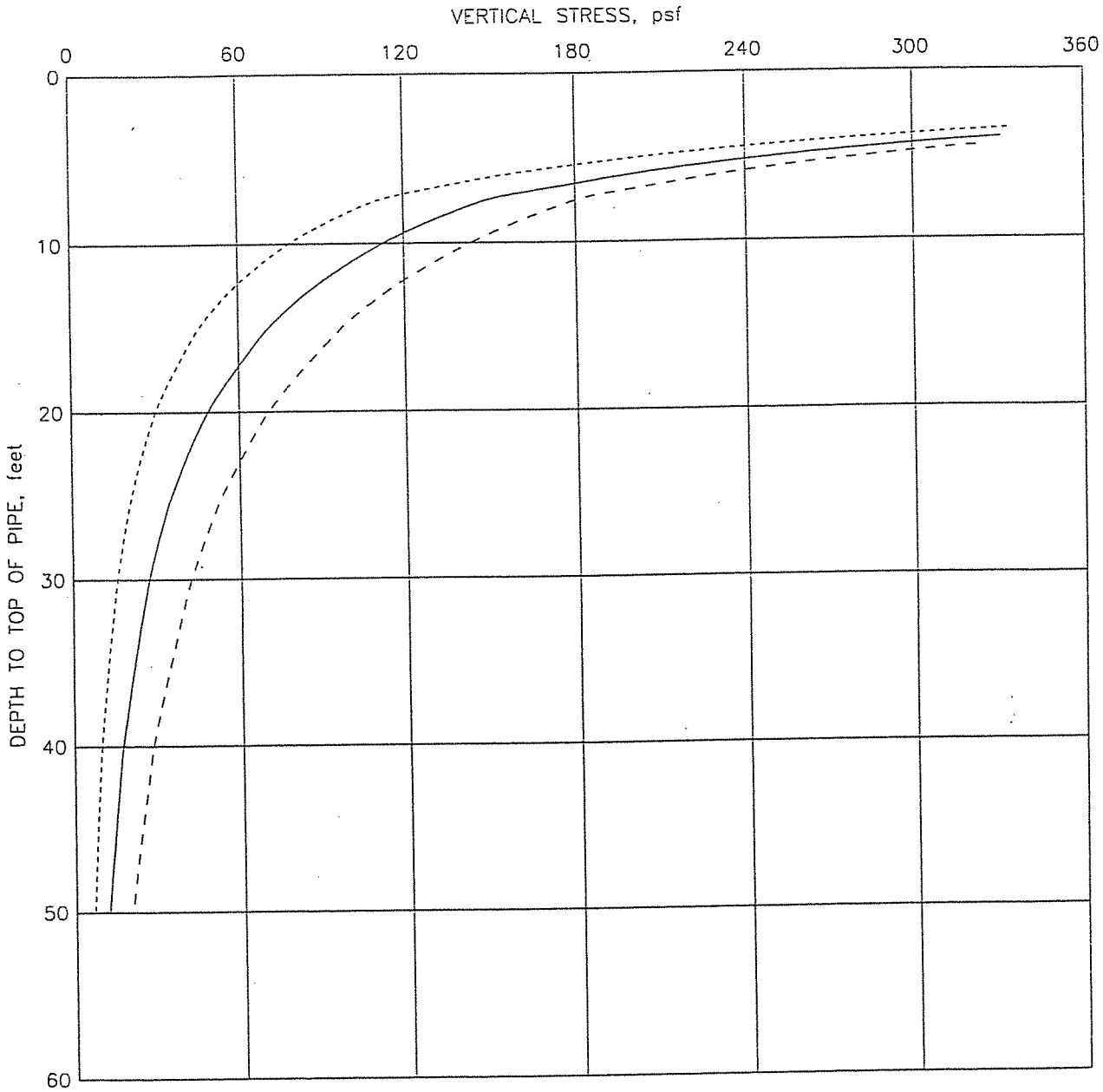
γ = Wet unit weight of soil, pcf (see Table 3)

γ_w = Unit weight of water, 62.4 pcf

q_s = Surcharge load, psf.

EARTH PRESSURE ON PIPE AND CASING AUGERING

Job No. 1140194601

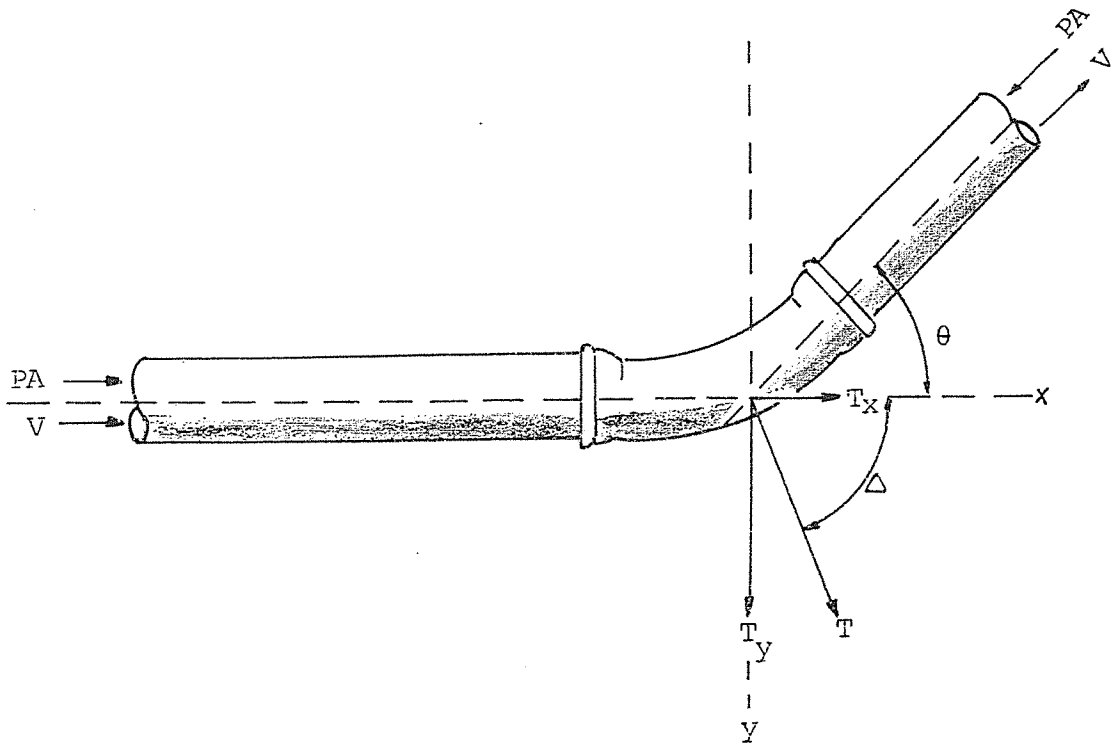


Legend:

------ One passing truck
_____ Two passing trucks
_ _ _ Four passing trucks

Notes: 1. The vertical stress wos estimated using AASHTO H20 or HS20 truck axle loadings on paved surfaces.
2. Impact factor was included in the vertical stress.

VERTICAL STRESS ON PIPES DUE TO TRAFFIC LOADS



$T_x = PA\ (1 - COS\ \theta)$

$T_y = PA\ SIN\ \theta$

$T = 2\ PA\ SIN\ \frac{\theta}{2}$

$\Delta = (90 - \frac{\theta}{2})$

Where:

T	is the resultant force on the bend
T_x	is the component of thrust force in x-direction
T_y	is the component of thrust force in y-direction
P	is the maximum sustained pressure
A	is the pipe cross-sectional area
θ	is the bend deflection angle
Δ	is the angle between T and X-axis
V	is the fluid velocity

THRUST FORCES ACTING ON A BEND

TABLES

TABLE 1

SUMMARY OF BORING INFORMATION

Boring No.	Depth (feet)	Street	Northing	Easting	Elevation (feet)
GB-1 (GB-1P)	15	Chadbourne	13844243.94	3046683.66	79.83
GB-2	14	Chadbourne	13844258.25	3047275.18	78.43
GB-3	14	Chadbourne	13844129.71	3047759.34	79.92
GB-4	14	Chadbourne	13844131.38	3048183.83	75.71
GB-5	14	Chadbourne	13844237.05	3048759.23	75.26
GB-6	15	Broadgreen	13843919.24	3046560.45	80.75
GB-7	15	Kickerillo	13843892.19	3047307.15	78.07
GB-8	15	Broadgreen	13843818.17	3047920.47	76.54
GB-9	22	Broadgreen	13843905.80	3048533.39	74.19
GB-10	15	Broadgreen	13843878.34	3049030.75	74.17
GB-11	19	Cindywood	13843664.30	3046957.35	77.48
GB-12	14	Cindywood	13843564.64	3047664.63	72.96
GB-13	17	Cindywood	13843561.43	3048243.29	72.52
GB-14	17	Cindywood	13843607.14	3048763.96	70.14
GB-15	14	Carolcrest	13843355.78	3046709.27	76.94
GB-16	14	Carolcrest	13843362.63	3047243.59	71.98
GB-17	14	Carolcrest	13843243.50	3047920.79	72.50
GB-18	17	Carolcrest	13843321.25	3048601.27	69.37
GB-19	14	Carolcrest	13843131.65	3048991.27	69.55
GB-20	13	Kellywood	13843051.86	3047189.44	71.31
GB-21	13	Kellywood	13842958.31	3047606.37	70.30
GB-22 (GB-22P)	18	Kellywood	13842946.14	3048243.63	68.27
GB-23	13	Rainwood	13844596.67	3048061.66	79.60
GB-24	14	Clear Spring	13844649.15	3048611.17	78.78
GB-25	14	Apple Tree Lane	13844522.69	3049019.26	78.41
GB-26	13	Hickory Post Lane	13841898.46	3048966.06	69.29
GB-27	13	Hickory Post Lane	13842412.61	3048975.57	70.56

TABLE 1 (cont'd)
SUMMARY OF BORING INFORMATION

Boring No.	Depth (feet)	Street	Northing	Easting	Elevation (feet)
GB-28	14	Apple Tree Lane	13844373.27	3050343.63	71.66
GB-29	20	Blue Bird Lane	13843979.32	3050478.92	70.94
GB-30	15	Cardinal Lane	13843589.40	3050451.61	70.74
GB-31	15	Cindywood Circle	13843196.35	3050374.35	67.14
GB-32	18	Carolcrest	13842785.19	3050359.24	67.94
GB-33	14	Kellywood Lane	13842469.02	3050530.51	68.84
GB-34	15	River Forest	13841932.22	3050082.07	68.39
GB-35	15	River Forest	13842119.32	3050487.34	68.74
GB-36 (GB-36P)	14	Heatherfield	13841495.30	3050236.19	67.50
GB-37	14	Heatherfield	13841794.36	3050560.07	68.24
GB-38	15	Rancho Bauer	13841480.11	3049425.92	70.91
GB-39	15	Rancho Bauer	13841997.23	3049446.47	71.64
GB-40	15	Rancho Bauer	13842530.31	3049419.47	70.91
GB-41	20	Rancho Bauer	13842978.92	3049396.04	71.74
GB-42	20	Rancho Bauer	13843502.85	3049369.83	71.19
GB-43	20	Rancho Bauer	13843985.76	3049344.49	72.45
GB-44	15	Rancho Bauer	13844503.54	3049319.70	78.45
GB-45	15	White Wing Lane	13842407.41	3049986.91	69.55
GB-46	20	White Wing Lane	13842914.11	3049943.69	69.75
GB-47	15	White Wing Lane	13843409.84	3049930.89	70.79
GB-48	20	White Wing Lane	13843798.31	3050037.51	71.20
GB-49 (GB-49P)	20	White Wing Lane	13844278.18	3050013.93	72.30
GB-50	15	White Wing Lane	13844731.14	3049992.74	74.90

TABLE 2

GEOTECHNICAL DESIGN PARAMETER SUMMARY
OPEN-CUT EXCAVATION (AUGER PITS)

Alignments	Boring Nos.	Stratigraphic Unit	Range of Depths, ft	Wet Unit Weight, γ, pcf	Submerged Unit Weight, γ', pcf	Undrained Cohesion, psf	Internal Friction Angle, φ, degree
8" Waterline along Chadbourne Drive	GB-1 thru GB-5	Cohesive	0-10 10-12 12-14	111 128 128	56 66 66	1,500 2,500 1,200	-- -- --
8" and 6" Waterline along Broadgreen Drive	GB-6, GB-8, GB-10	Cohesive	0-5 5-8 8-14 14-15	125 125 129 129	62 62 65 65	1,200 1,500 1,200 700	-- -- -- --
	GB-9	Cohesive Cohesionless Cohesive Cohesionless Cohesive	0-6 6-12 12-13 13-15 15-17 17-22	130 130 110 120 111 120	65 65 55 58 48 58	4,000 1,500 -- 1,200 -- 1,200	-- -- 30 -- 30 --
8" Waterline along Cindywood Drive	GB-11 and GB-12	Cohesive Cohesionless	0-12 12-14 14-19 (GB-11 only)	128 104 111	64 42 48	1,500 -- --	-- 28 32
	GB-13	Cohesive	0-6 6-12 12-17	130 130 129	65 65 67	600 1,800 1,200	-- -- --
	GB-14	Cohesive Cohesionless Cohesive	0-8 8-10 10-12 12-14 14-17	132 132 105 118 120	66 70 43 56 58	1,000 800 -- 900 4,000	-- -- 25 -- --
8" Waterline along Carolcrest Drive	GB-15 thru GB-17 and GB-19	Cohesive	0-14	130	65	1,000	--
	GB-18	Cohesive Cohesionless Cohesive	0-8 8-14 14-16 16-17	127 127 111 120	65 65 48 58	2,000 1,200 -- 2,100	-- -- 30 --
8" Waterline along Kellywood Lane	GB-20 thru GB-22	Cohesive	0-14 14-18	129 120	66 58	900 3,500	-- --
6" Waterline along Rainwood Drive	GB-23 and GB-4	Cohesive	0-10 10-14	132 120	66 58	2,000 4,000	-- --

TABLE 2 (cont'd)

GEOTECHNICAL DESIGN PARAMETER SUMMARY
OPEN-CUT EXCAVATION (AUGER PITS)

Alignments	Boring Nos.	Stratigraphic Unit	Range of Depths, ft	Wet Unit Weight, γ, Pcf	Submerged Unit Weight, γ', pcf	Undrained Cohesion, psf	Internal Friction Angle, φ, degree
8" Waterline along Clear Spring Drive	GB-24	Cohesive	0-4	131	65	3,000	--
			4-10	131	65	1,800	--
			10-12	117	59	900	--
			12-14	117	59	4,000	--
	GB-9	Cohesive	0-6	130	65	4,000	--
			6-12	130	65	1,500	--
		Cohesionless	12-13	110	55	--	30
		Cohesive	13-15	120	58	1,200	--
		Cohesionless	15-17	111	48	--	30
		Cohesive	17-22	120	58	1,200	--
8" Waterline along Apple Tree Lane	GB-25	Cohesive	0-10	127	64	2,000	--
			10-12	127	64	3,000	--
			12-14	127	64	4,000	--
8" Waterline along Hickory Post Lane	GB-26 and GB-27	Cohesive	0-2	130	65	1,500	--
			2-6	130	65	3,000	--
			6-13	130	65	1,500	--
8" Waterline along Apple Tree Lane	GB-28 and GB-49	Cohesive	0-14	132	67	1,500	--
			14-16 (GB-49 only)	136	73	1,500	--
			16-20 (GB-49 only)	136	73	2,500	--
8" Waterline along Blue Bird Lane	GB-29 and GB-43	Cohesive	0-10	135	67	1,500	--
			10-14	135	67	1,000	--
			14-18	130	65	700	--
			18-20	130	65	3,500	--
8" Waterline along Cardinal Lane	GB-30 and GB-42	Cohesive	0-10	128	64	3,500	--
			10-15	129	64	1,500	--
			15-20	129	64	2,000	--
8" Waterline along Cindywood Circle	GB-31	Cohesive	0-8	131	65	2,000	--
			8-15	131	65	1,000	--
8" Waterline along Carolcrest Drive	GB-32	Cohesive	0-6	133	67	2,000	--
			6-10	133	67	1,000	--
		Cohesionless	10-12	97	48	--	30
		Cohesive	12-18	137	68	2,000	--

TABLE 2 (cont'd)

GEOTECHNICAL DESIGN PARAMETER SUMMARY
OPEN-CUT EXCAVATION (AUGER PITS)

Alignments	Boring Nos.	Stratigraphic Unit	Range of Depths, ft	Wet Unit Weight, γ, Pcf	Submerged Unit Weight, γ', pcf	Undrained Cohesion, psf	Internal Friction Angle, φ, degree
8" Waterline along Kellywood Lane	GB-33	Cohesive	0-8 8-14	132 132	66 66	2,000 1,000	-- --
8" Waterline along River Forest Drive	GB-34	Cohesive	0-10 10-13 13-15	132 132 132	66 66 66	3,800 1,500 1,000	-- -- --
	GB-35	Cohesive Cohesionless Cohesive	0-8 8-12 12-13.5 13.5-15	132 132 98 132	66 66 49 66	3,800 2,200 -- 1,500	-- -- 30 --
8" Waterline along Heatherfield Drive	GB-36 and GB-37	Cohesive	0-2 2-10 10-14	134 134 134	67 67 67	800 1,600 2,500	-- -- --
8" Waterline along Rancho Bauer Drive	GB-38 thru GB-44	Cohesive	0-6 6-13 13-18 18-20	128 132 127 127	64 66 63 63	1,000 1,500 700 2,000	-- -- -- --
8" Waterline along White Wing Lane	GB-45 thru GB-50	Cohesive	0-15 15-20	133 130	67 65	1,000 1,500	-- --

Note: 1) Cohesive soils include Sandy Lean Clay, Lean Clay w/sand, Lean Clay, Fat Clay w/sand and Fat Clay.
2) Cohesionless soils include Silty Sand, Sandy Silt, Clayey Silt, and Silt w/sand.

TABLE 3

GEOTECHNICAL DESIGN PARAMETER SUMMARY
TRENCHLESS INSTALLATION

PROPERTY		COHESIVE SOILS[1]	COHESIONLESS SOILS[2]
Wet Unit Weight, γ, pcf			
	0-6	130	--
	6-10	132	--
	10-12	130	101 (GB-14 and GB-32 only)
	12-14	130	104 (GB-9, GB-11, GB-12 and GB-35 only)
	14-16	130	111 (GB-18 only)
	16-18	128	111 (GB-9 only)
	18-20	127	--
	20-22	120	--
Submerged Unit Weight, γ', pcf			
	0-6	65	--
	6-10	66	--
	10-12	65	51 (GB-14 and GB-32 only)
	12-14	65	42 (GB-9, GB-11, GB-12 and GB-35 only)
	14-16	65	49 (GB-18 only)
	16-18	66	49 (GB-9 only)
	18-20	65	--
	20-22	58	--
Moisture Content (%)			
	0-6	15	--
	6-10	17	--
	10-12	20	15 (GB-14 and GB-32 only)
	12-14	19	18 (GB-9, GB-11, GB-12 and GB-35 only)
	14-16	17	26 (GB-18 only)
	16-18	18	23 (GB-9 only)
	18-20	20	--
	20-22	18	--
UNDRAINED PROPERTIES			
Undrained Cohesion, C_u, psf			
	1-6*	600	--
	6-10*	1,000	--
	10-12*	900	--
	12-14*	900	--
	14-16*	700	--
	16-18*	700	--
	18-20*	1,500	--
Angle of Internal Friction, ϕ, degrees	1-6*	--	--
	6-10*	--	--
	10-12*	--	30 (GB-14 and GB-32 only)
	12-14*	--	30 (GB-9, GB-11, GB-12 and GB-35 only)
	14-16*	--	30 (GB-18 only)
	16-18*	--	30 (GB-9 only)
	18-20*	--	--

TABLE 3 (cont'd)

GEOTECHNICAL DESIGN PARAMETER SUMMARY
TRENCHLESS INSTALLATION

PROPERTY		COHESIVE SOILS[1]	COHESIONLESS SOILS[2]
UNDRAINED PROPERTIES			
Elastic Modulus, E, psf			
	1-6*	180,000	--
	6-10*	300,000	--
	10-12*	270,000	128,000 (GB-14 and GB-32 only)
	12-14*	270,000	112,000 (GB-9, GB-11, GB-12 and GB-35 only)
	14-16*	210,000	152,000 (GB-18 only)
	16-18*	210,000	216,000 (GB-9 only)
	18-20*	600,000	--
Coefficient of Lateral Earth Pressure at Rest, K_o,	1-6*	1.2	--
	6-10*	1.2	--
	10-12*	1.2	0.5 (GB-14 and GB-32 only)
	12-14*	1.2	0.5 (GB-9, GB-11, GB-12 and GB-35 only)
	14-16*	1.2	0.5 (GB-18 only)
	16-18*	1.2	0.5 (GB-9 only)
	18-20*	1.2	--
Poisson's Ratio, μ		0.45	0.3
DRAINED PROPERTIES			
Drained Cohesion, C', psf			
	1-6*	0	--
	6-10*	0	--
	10-12*	0	--
	12-14*	0	--
	14-16*	0	--
	16-18*	0	--
	18-20*	0	--
Angle of Internal Friction, ϕ', degrees	1-6*	23	--
	6-10*	23	--
	10-12*	24	30 (GB-14 and GB-32 only)
	12-14*	24	30 (GB-9, GB-11, GB-12 and GB-35 only)
	14-16*	22	30 (GB-18 only)
	16-18*	22	30 (GB-9 only)
	18-20*	26	--
Elastic Modulus, E, psf			
	1-6*	108,000	--
	6-10*	180,000	--
	10-12*	162,000	128,000 (GB-14 and GB-32 only)
	12-14*	162,000	112,000 (GB-9, GB-11, GB-12 and GB-35 only)
	14-16*	126,000	152,000 (GB-18 only)
	16-18*	126,000	216,000 (GB-9 only)
	18-20*	360,000	--

Notes:
1. Cohesive soils include Fat Clay, Fat Clay with sand, Lean Clay, Lean Clay with sand and Sandy Lean Clay.
2. Cohesionless soil includes Sandy Silt, Clayey Silt, Silty Sand and Silt w/sand.

* Tunnel zone which includes invert depth plus 6 feet above invert plus 6 feet below invert.

APPENDIX A

LOG OF BORING NO. GB-1 (GB-1P)

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13844243.94, E 3046683.66
Chadbourne Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 79.83 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
79.8	0								
79.4		5.5" Concrete							
		Very stiff to hard gray and brown LEAN CLAY (CL) w/sand				15			
		-w/ferrous stains and ferrous nodules 2'-8'				12			
	5	-hard 4'-6'							
		-w/calcareous nodules 4'-8'		72	122	12	43	16	27
		-reddish brown and gray 6'-8'				21			
71.8		Very stiff to hard reddish brown and gray FAT CLAY (CH), slickensided w/calcareous and ferrous nodules		93	103	23	71	26	45
	10					23			
						29			
64.8	15					23			
		NOTE : See Piezometer GB-1P for water level measurements.							
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
▼: WATER DEPTH AT 11.3 FT., HOLE OPEN TO 15.0 FT. ON 06-08-13.

Geotest Engineering, Inc.

FIGURE A-1

LOG OF BORING NO. GB-2

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13844258.25, E 3047275.18
Chadbourne Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 14.0 FT.

SURFACE ELEVATION : 78.43 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : -- TO -- FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
78.4	0								
78.0		5.5" Concrete							
		Very stiff yellowish brown and gray LEAN CLAY (CL) w/sand, ferrous stains and ferrous nodules				16			
						16			
	5	-w/calcareous nodules 4'-10'				15			
		-reddish brown and gray 8'-10'		79	108	19	44	16	28
68.4	10					19			
		Very stiff reddish brown and gray FAT CLAY (CH) w/calcareous nodules				30			
66.4									
		Stiff to very stiff reddish brown and gray LEAN CLAY (CL) w/sand, calcareous nodules and ferrous stains				17			
64.4	15								
	20								
	25								
	30								
	35								

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-2

LOG OF BORING NO. GB-3

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13844129.71, E 3047759.34
Chadbourne Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 14.0 FT.

SURFACE ELEVATION : 79.92 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : -- TO -- FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
79.9	0								
79.5		5.5" Concrete							
		Stiff to very stiff gray and brown SANDY LEAN CLAY (CL) w/ferrous stains and sand seams				13			
		-very stiff to hard 2'-4'				13			
	5	-w/ferrous nodules 2'-10'							
		-yellowish gray and brown 4'-6'		70		14	42	14	28
		-very stiff 4'-8'				15			
		-w/vertical sand seams and calcareous nodules 8'-10'							
69.9	10					17			
		Very stiff gray and reddish brown FAT CLAY (CH) w/sand seams		87	103	25	59	23	36
65.9						31			
	15								
	20								
	25								
	30								
	35								

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-3

LOG OF BORING NO. GB-4

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13844131.38, E 3048183.83
Chadbourne Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 14.0 FT.

SURFACE ELEVATION : 75.71 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
75.7	0								
75.3		5.5" Concrete							
		Very stiff yellowish brown and gray LEAN CLAY (CL) w/ferrous stains, sand and calcareous and ferrous nodules				15			
						17			
	5	-stiff to very stiff w/vertical sand seams 2'-4'		79	112	22	46	20	26
69.7		-gray and reddish brown 4'-6'				24			
		Very stiff gray and reddish brown FAT CLAY (CH) w/sand seams		98		25	63	24	39
	10	-hard 8'-14'				18			
61.7						21			
	15								
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-4

LOG OF BORING NO. GB-5

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13844237.05, E 3048759.23
Chadbourne Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 14.0 FT.

SURFACE ELEVATION : 75.26 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
75.3	0								
74.7		6.25" Concrete							
		Stiff dark gray FAT CLAY (CH) w/sand seams				23			
		-gray 2'-4'							
		-w/ferrous nodules 2'-8'		87		20	52	21	31
	5	-very stiff 4'-6'							
		-w/calcareous nodules and ferrous stains 4'-14'				19			
		-stiff to very stiff 6'-10'							
		-gray and reddish brown 6'-14'				19			
	10	-hard 10'-14'		97	105	21	55	22	33
						22			
61.3						20			
	15								
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-5

LOG OF BORING NO. GB-6

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843919.24, E 3046560.45
Broadgreen Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 80.75 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
80.8	0								
80.3		6" Concrete							
		Stiff to very stiff dark gray LEAN CLAY (CL) w/sand, ferrous nodules and ferrous stains -stiff 2'-4' -very stiff yellowish brown and gray w/calcareous nodules 4'-8'		76	104	20	49	19	30
	5					18			
72.8						18			
		Stiff to very stiff gray and reddish brown FAT CLAY (CH) w/sand seams and calcareous nodules -slickensided 8'-10' -hard 10'-15'		91	102	25	64	25	39
	10					25			
						26			
65.8	15					22			
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 15.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-6

LOG OF BORING NO. GB-7

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843892.19, E 3047307.15
Kickerillo Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 78.07 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
78.1	0								
77.6		6" Concrete							
		Hard red, yellowish brown and gray LEAN CLAY (CL) w/sand and ferrous nodules and ferrous stains				12			
						13			
	5								
		-very stiff 6'-8'		80		14	46	20	26
70.1						22			
		Very stiff reddish brown and gray FAT CLAY (CH) w/sand seams, ferrous stains and calcareous nodules		90	102	25	75	28	47
	10								
66.1						23			
		Stiff to very stiff reddish brown and gray LEAN CLAY (CL) w/silt and sand seams				21			
63.1	15					22			
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 15.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-7

LOG OF BORING NO. GB-8

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843818.17, E 3047920.47
Broadgreen Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 76.54 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
76.5	0								
76.1		5.5" Concrete							
		Stiff dark gray FAT CLAY (CH) w/sand and ferrous nodules				23			
		-gray 2'-4'				21			
	5	-groy and brown 4'-8'							
		-very stiff w/calcareous nodules 4'-10'		79	110	20	57	17	40
		-gray and reddish brown w/sand seams 8'-10'				24			
66.5	10					24			
		Very stiff gray and reddish brown LEAN CLAY (CL) w/silt and sand seams		90	106	23	46	21	25
		-stiff 14'-15'				20			
61.5	15					21			
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 15.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-8

LOG OF BORING NO. GB-9

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843905.80, E 3048533.39
Broadgreen Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 22.0 FT.

SURFACE ELEVATION : 74.19 FT.

DATE : 05-07-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 22.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
74.2	0	7" Concrete							
73.6		Brown SANDY LEAN CLAY (CL)				15			
72.2		Hard gray and brown FAT CLAY (CH) w/calcareous and ferrous nodules and ferrous stains				14			
	5	-stiff to very stiff 6'-8'				13			
		-very stiff 8'-10'		90	111	17	60	24	36
64.2	10	Stiff yellowish gray and brown SANDY LEAN CLAY (CL) w/ferrous nodules and clayey sand seams				20			
62.2						19			
61.2		Gray SILTY SAND (SM)		50		20			
59.2	15	Stiff to very stiff gray and brown SANDY LEAN CLAY (CL) w/sand layer				19			
			27			23			
57.2		Medium dense reddish brown CLAYEY SILT (ML) w/silt seams		91	106	20	27	21	6
	20	Stiff to very stiff reddish brown SILTY CLAY (CL-ML) w/calcareous nodules							
52.2		-w/sand stone 17'-18'				18			
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- HAND PENETROMETER
- UNCONFINED COMPRESSION
- UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 12.0 FT. DURING DRILLING; AFTER 15.0 MIN. AT 8.3 FT.
HOLE OPEN TO 22.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-9

LOG OF BORING NO. GB-10

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843878.34, E 3049030.75
Broadgreen Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 74.17 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
74.2	0	6" Concrete							
73.7		Very stiff dark gray LEAN CLAY (CL) w/sand, ferrous nodules and ferrous stains -gray 2'-4' -yellowish brown and gray w/calcareous nodules 4'-8'				17 16 20 19			
66.2	10	Stiff to very stiff yellowish brown and gray FAT CLAY (CH) w/sand, ferrous stains and calcareous nodules		82	106	22	53	22	31
62.2		Stiff reddish brown and gray LEAN CLAY (CL) w/silt seams and -medium stiff very silty clay w/clay stone 14'-15'				21 21 23			
59.2	15								
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 15.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-10

LOG OF BORING NO. GB-11

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843664.30, E 3046957.35
Cindywood Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 19.0 FT.

SURFACE ELEVATION : 77.48 FT.

DATE : 05-02-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : 14.0 TO 19.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
77.5	0	9" Concrete							
76.7		Very stiff to hard yellowish brown and gray LEAN CLAY (CL) w/sand, ferrous nodules and ferrous stains				14			
73.5	5	Very stiff reddish brown and gray FAT CLAY (CH) w/sand, calcareous nodules and silt seams -slickensided 4'-6' -stiff to very stiff 6'-10'		84	102	26 28 31	61	25	36
67.5	10	Very stiff to hard reddish brown and gray LEAN CLAY (CL) w/calcareous nodules				18			
65.5		Medium dense gray and reddish brown SANDY SILT (ML) w/clay seams	12	66		21			
	15	-very dense w/clay stone 17.5'-19'							
58.5			100/4.5"			19			
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 14.0 FT. DURING DRILLING; AFTER 15.0 MIN. AT 11.7 FT.
HOLE OPEN TO 19.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-11

LOG OF BORING NO. GB-12

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843564.64, E 3047664.63
Cindywood Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 14.0 FT.

SURFACE ELEVATION : 72.96 FT.

DATE : 05-07-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 14.0 FT.

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
73.0	0			9" Concrete							
72.2				Very stiff gray LEAN CLAY (CL) w/sand, ferrous nodules and ferrous stains -stiff to very stiff w/calcareous nodules 2'-4'				16			
69.0	5							17			
				Stiff reddish brown FAT CLAY (CH) w/sand, calcareous nodules and ferrous stains -very stiff 6'-8'		84	101	27	64	25	39
65.0								23			
	10			Stiff to very stiff reddish brown and gray SILTY CLAY (CL-ML) w/silt seams and calcareous nodules -medium stiff to stiff 10'-12'				21			
61.0							114	22			
59.0				Reddish brown CLAYEY SILT (ML) w/silt stone -w/silty clay 13.5'-14'				19			
	15										
	20										
	25										
	30										
	35										

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 12.0 FT. DURING DRILLING; AFTER 15.0 MIN. AT 7.3 FT.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-12

LOG OF BORING NO. GB-13

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843561.43, E 3048243.29
Cindywood Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 17.0 FT.

SURFACE ELEVATION : 72.52 FT.

DATE : 05-07-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 17.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
72.5	0	7.75" Concrete							
71.9		FILL: medium stiff to stiff gray fat clay w/calcareous and ferrous nodules				20			
		-w/vertical sand seams 7.75"-8'				27			
	5	-medium stiff to stiff gray and brown 2'-4'							
66.5		-stiff reddish brown 4'-6'				19			
		Stiff to hard gray and reddish brown FAT CLAY (CH) w/sand seams, ferrous stains and calcareous nodules		93	100	30	54	22	32
62.5	10	-slickensided 6'-8'				25			
		-hard 8'-10'				22			
		Very stiff reddish brown and gray LEAN CLAY (CL) w/calcareous nodules and sand seams		95	107	21	29	20	9
	15	-stiff to very stiff w/silt layers 12'-14'				22			
55.5		-stiff 14'-16'				14			
		-gray sand 15.7'-16'							
		-stiff to hard w/silt stone 16'-17'							
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 12.0 FT. DURING DRILLING; AFTER 15.0 MIN. AT 10.4 FT.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-13

LOG OF BORING NO. GB-14

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843607.14, E 3048763.96
Cindywood Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 17.0 FT.

SURFACE ELEVATION : 70.14 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 17.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
70.1	0	8.75" Concrete							
69.4		Stiff yellowish brown and gray LEAN CLAY (CL) w/sand, ferrous stains, and calcareous and ferrous nodules				21			
						19			
	5	-stiff to very stiff 4'-6'							
		-very stiff 6'-8'		71	112	18	43	16	27
		-medium stiff very sandy clay 8'-10'				17			
60.1	10					20			
		Reddish brown and gray CLAYEY SILT (ML)							
58.1		-w/sand layer 10'-11'				19			
		Medium stiff to stiff reddish brown LEAN CLAY (CL) w/silt seams			96	23	28	19	9
56.1	15								
		Hard reddish brown FAT CLAY (CH) w/silt seams		100		23	57	23	34
53.1						24			
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 11.0 FT. DURING DRILLING; AFTER 20.0 MIN. AT 8.6 FT.
HOLE OPEN TO 17.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-14

LOG OF BORING NO. GB-15

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houstan, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843355.78, E 3046709.27
Carolcrest Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 14.0 FT.

SURFACE ELEVATION : 76.94 FT.

DATE : 05-08-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
76.9	0								
76.4		6" Concrete							
		Very stiff gray and brown LEAN CLAY (CL) w/ferrous stains, sand and ferrous nodules				16			
72.9	5					14			
		Very stiff gray and reddish brown FAT CLAY (CH) w/calcareous and ferrous nodules -very stiff to hard 6'-8' -stiff to very stiff 8'-10' -w/silt seams 8'-15'				23			
						20			
	10	-very stiff to hard 10'-12'		92	104	26	50	21	29
						23			
62.9						20			
	15								
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-15

LOG OF BORING NO. GB-16

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843362.63, E 3047243.59
Carolcrest Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 14.0 FT.

SURFACE ELEVATION : 71.98 FT.

DATE : 05-08-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
72.0	0								
71.3		8.5" Concrete							
		Medium stiff to stiff dark gray LEAN CLAY (CL) w/sand, calcareous nodules and ferrous stains				20			
		-stiff 2'-6'				17			
	5	-gray 4'-14'							
		-stiff to very stiff 6'-8'				20			
		-stiff 8'-10'		73	111	20	46	20	26
	10					21			
		-very sandy clay 12'-14'				20			
58.0						19			
	15								
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-16

LOG OF BORING NO. GB-17

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843243.50, E 3047920.79
Coralcrest Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 14.0 FT.

SURFACE ELEVATION : 72.50 FT.

DATE : 05-08-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
72.5	0								
72.0		6" Concrete							
		Stiff gray and brown LEAN CLAY (CL) w/ferrous stains, calcareous and ferrous nodules				19			
		-stiff to very stiff 2'-4'				18			
	5	-medium stiff to stiff 4'-6'				18			
		-stiff to very stiff 6'-8'							
		-gray and reddish brown 6'-14'				23			
		-very stiff 8'-14'							
	10	-w/silt seams 10'-12'		86	107	21	47	20	27
						21			
58.5						23			
	15								
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-17

LOG OF BORING NO. GB-18

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843321.25, E 3048601.27
Carolcrest Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 17.0 FT.

SURFACE ELEVATION : 69.37 FT.

DATE : 05-08-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : 14.0 TO 17.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
69.4	0								
68.7		7.5" Concrete							
		Very stiff yellowish brown and gray LEAN CLAY (CL) w/sand, calcareous and ferrous nodules and ferrous stains				17			
						17			
	5	-gray silty sand 5.5'-6'	19			19			
		-stiff to very stiff 8'-10'				23			
	10			79	107	19	45	19	26
		-stiff w/clayey sand layers 12'-14'				18			
55.4						18			
	15	Medium dense reddish brown SILT (ML) w/sand	19	72		26			
53.4						27			
52.4		Very stiff to hard reddish brown FAT CLAY (CH) w/silt seams and clay stone							
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 14.0 FT. DURING DRILLING; AFTER 15.0 MIN. AT 7.0 FT.
HOLE OPEN TO 17.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-18

LOG OF BORING NO. GB-19

PROJECT : COH Woter Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843131.65, E 3048991.27
Carolcrest Dr.; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 14.0 FT.

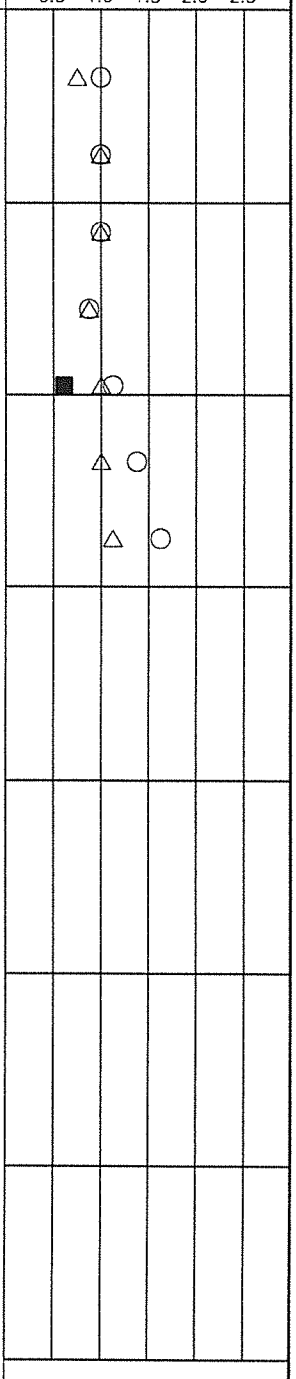
SURFACE ELEVATION : 69.55 FT.

DATE : 05-08-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
69.6	0								
69.1		5.25" Concrete							
		Stiff to very stiff dark gray SANDY LEAN CLAY (CL) w/sand seams				19			
		-very stiff gray and brown 2'-6'				18			
	5	-stiff 6'-8'				18			
		-w/calcoreous and ferrous nodules 6'-12'				19			
		-yellowish brown and gray w/ferrous stains 6'-14'							
	10	-very stiff 10'-14'		62	111	17	42	16	26
						17			
55.6						16			
	15								
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5



DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-19

LOG OF BORING NO. GB-20

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843051.86, E 3047189.44
Kellywood Lane; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 13.0 FT.

SURFACE ELEVATION : 71.31 FT.

DATE : 05-08-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 13.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
71.3	0	9" Concrete							
70.6		Hard gray LEAN CLAY (CL) w/sand, calcareous and ferrous nodules and ferrous stains -very stiff 4'-6'				14			
	5					12			
65.3		Stiff gray and brown FAT CLAY (CH) w/sand, ferrous nodules and ferrous stains		83	108	16	51	17	34
						19			
61.3	10	Medium stiff to stiff gray SANDY LEAN CLAY (CL) w/sand layers				20			
						18			
58.3						19			
	15								
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 13.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-20

LOG OF BORING NO. GB-21

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13842958.31, E 3047606.37
Kellywood Lone; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 13.0 FT.

SURFACE ELEVATION : 70.30 FT.

DATE : 05-08-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 13.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
70.3	0								
69.7		6.75" Concrete							
		Very stiff dark gray LEAN CLAY (CL) w/sand seams and ferrous nodules				16			
						16			
	5								
64.3		Stiff to very stiff yellowish brown and gray FAT CLAY (CH) w/sand, ferrous stains and ferrous nodules				17			
						21			
60.3	10	Medium stiff to stiff yellowish brown and gray SANDY LEAN CLAY (CL) w/sand seams, ferrous stains ond ferrous nodules		76	108	20	52	21	31
						18			
57.3						21			
	15								
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 13.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-21

LOG OF BORING NO. GB-22 (GB-22P)

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13842946.14, E 3048243.63
Kellywood Lane; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 18.0 FT.

SURFACE ELEVATION : 68.27 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 12.0 FT.
WET ROTARY : 12.0 TO 18.0 FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
68.3	0	9" Concrete							
67.5		Stiff dark gray LEAN CLAY (CL) w/sand -medium stiff to stiff 2'-6' -gray w/roots 2'-10'				19			
						11			
	5	-stiff to very stiff 6'-8'		80	111	17	30	15	15
		-medium stiff to stiff w/calcareous nodules 8'-10'				18			
58.3	10					17			
		Medium stiff to stiff reddish brown and gray LEAN CLAY (CL) w/silt seams -w/silt stone 12'-12'3"				23			
				99	102	24	29	17	12
53.3	15	Very stiff to hard reddish brown FAT CLAY (CH) -hard 16'-17' -w/clay stone seams 16'-18'				25			
				100		26	59	23	36
50.3									
	20	NOTE : See Piezometer GB-22P for water level measurements.							
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
▽: FREE WATER 1st ENCOUNTERED AT 12.0 FT. DURING DRILLING; AFTER 15.0 MIN. AT 11.7 FT.
▼: WATER DEPTH AT 4.7 FT., HOLE OPEN TO 18.0 FT. ON 06-08-13.

Geotest Engineering, Inc.

FIGURE A-22

LOG OF BORING NO. GB-23

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13844596.67, E 3048061.66
Rainwood Drive; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 13.0 FT.

SURFACE ELEVATION : 79.60 FT.

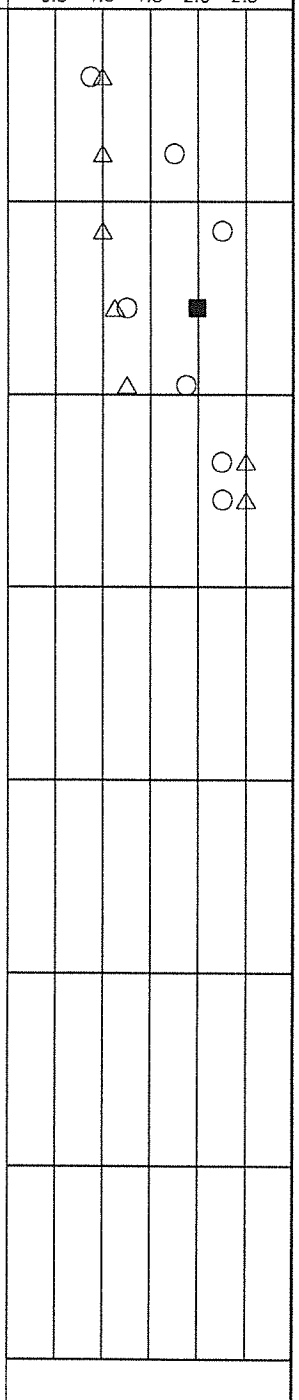
DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 13.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
79.6	0								
79.1		6" Concrete							
		Stiff to very stiff dark gray LEAN CLAY (CL) w/sand and ferrous stains				17			
		-very stiff 2'-4'				18			
	5	-very stiff to hard gray and yellow w/calcareous nodules 4'-6'				15			
73.6		Very stiff reddish brown and gray FAT CLAY (CH) w/sand seams, calcareous nodules and ferrous stains		88	105	23	67	25	42
	10	-hard 10'-14'				23			
				99		26	66	25	41
66.6						22			
	15								
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5



DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 13.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-23

LOG OF BORING NO. GB-24

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13844649.15, E 3048611.17
Clear Spring Drive; See Plon of Borings (Figure 2.1)

COMPLETION DEPTH : 14.0 FT.

SURFACE ELEVATION : 78.78 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
78.8	0								
78.2		7.5" Concrete							
		Very stiff gray and yellowish brown SANDY LEAN CLAY (CL) w/calcareous and ferrous nodules and ferrous stains				18			
						15			
	5	-stiff 6'-8'		70	112	17	41	17	24
70.8						17			
		Very stiff gray and reddish brown FAT CLAY (CH) w/sand seams and calcareous nodules				23			
	10	-medium stiff to stiff, slickensided 10'-12'		93	88	33	57	23	34
		-hard 12'-14'				22			
64.8									
	15								
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-24

LOG OF BORING NO. GB-25

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13844522.69, E 3049019.26
Apple Tree Road; See Plan of Borings (Figure 2.1)

COMPLETION DEPTH : 14.0 FT.

SURFACE ELEVATION : 78.41 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
78.4	0	7" Concrete							
77.8		Very stiff dark gray LEAN CLAY (CL) w/sand, ferrous nodules and ferrous stains				17			
		-hard 2'-4'				14			
	5	-very stiff to hard gray and yellow 4'-6'				15			
72.4		Very stiff gray and reddish brown FAT CLAY (CH) w/calcareous nodules, ferrous stains and sand seams		86	105	21	65	25	40
	10					22			
		-hard 12'-14'		96		29	69	26	43
64.4						21			
	15								
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-25

LOG OF BORING NO. GB-26

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13841898.46, E 3048966.06
Hickory Post Lone; See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 13.0 FT.

SURFACE ELEVATION : 69.29 FT.

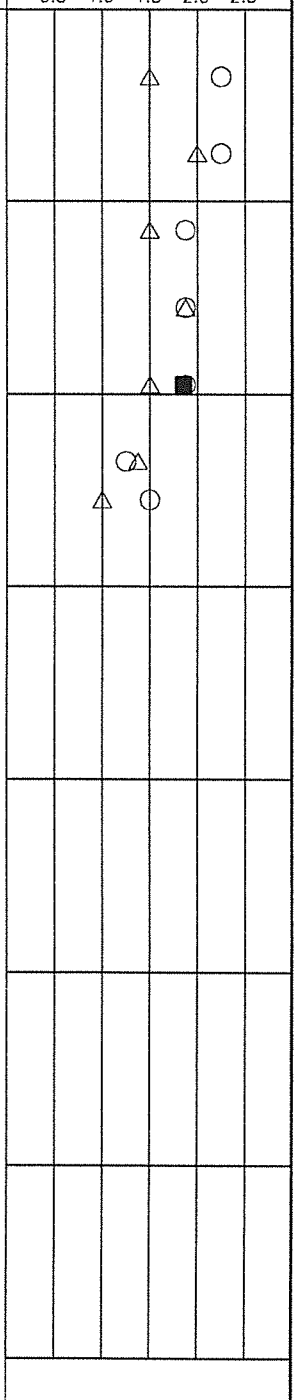
DATE : 05-08-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 13.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
69.3	0								
68.7		6.75" Concrete							
		Very stiff to hard gray LEAN CLAY (CL) w/sand, ferrous nodules and ferrous stains				14			
		-hard 2'-4'				14			
	5	-very stiff 4'-13'				16			
						16			
	10	-yellowish brown and gray 10'-14'		80	115	16	45	19	26
						16			
56.3						17			
	15								
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5



DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 13.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-26

LOG OF BORING NO. GB-27

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13842412.61, E 3048975.57
Hickory Post Lane; See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 13.0 FT.

SURFACE ELEVATION : 70.56 FT.

DATE : 05-08-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 13.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
70.6	0								
70.1		6" Concrete							
		Stiff to very stiff gray LEAN CLAY (CL) w/ferrous nodules and ferrous stains -very stiff to hard 2'-6' -yellowish brown and gray 4'-13'				19			
	5					14			
						16			
		-stiff 8'-10'				19			
	10	-very stiff 10'-12'		88	106	21	49	21	28
		-stiff 12'-13'				18			
57.6						20			
	15								
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 13.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-27

LOG OF BORING NO. GB-28

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13844373.27, E 3050343.63
Apple Tree Lane; See Plan of Borings (Figure 2.3)

COMPLETION DEPTH : 14.0 FT.

SURFACE ELEVATION : 71.66 FT.

DATE : 05-07-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
71.7	0								
71.2		6" Asphalt							
		Stiff to very stiff gray LEAN CLAY (CL) w/sand				13			
						18			
	5	-very stiff 4'-8'							
		-w/calcoreous and ferrous nodules 4'-14'				16			
						16			
		-gray and yellowish brown 8'-14'							
	10	-w/roots 10'-14'		76	110	20	49	20	29
						19			
57.7						18			
	15								
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- HAND PENETROMETER
- UNCONFINED COMPRESSION
- UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-28

LOG OF BORING NO. GB-29

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843979.32, E 3050478.92
Blue Bird Lane; See Plan of Borings (Figure 2.3)

COMPLETION DEPTH : 20.0 FT.

SURFACE ELEVATION : 70.94 FT.

DATE : 05-07-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 20.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
70.9	0	15.5" Asphalt							
69.6		Stiff to very stiff gray SANDY LEAN CLAY (CL) w/sand seams				17			
		-very stiff 2'-6'				17			
	5	-gray w/calcareous nodules 4'-10'				16			
		-w/ferrous nodules and ferrous stains 6'-20'		66	116	18	46	20	26
		-very stiff 8'-14'							
		-gray and yellow 8'-20'				18			
	10					16			
						17			
		-stiff 14'-16'							
	15			68	116	16	35	16	19
		-stiff to very stiff 16'-20'				17			
		-w/calcareous nodules 18.5'-20'							
50.9	20					15			
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 20.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-29

LOG OF BORING NO. GB-30

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843589.40, E 3050451.61
Cardinal Lane; See Plan of Borings (Figure 2.3)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 70.74 FT.

DATE : 05-07-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
70.7	0	11.5" Asphalt							
69.8		Hard gray LEAN CLAY (CL) w/sand and ferrous nodules				15			
						14			
	5	-w/sand seams 6'-15'				15			
		-gray and yellowish brown w/calcareous nodules 8'-15'				16			
	10	-very stiff 10'-11'				17			
		-stiff 11'-13'				18			
		-very stiff 13'-15'		75	109	18	43	19	24
55.7	15					17			
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 15.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-30

LOG OF BORING NO. GB-31

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843196.35, E 3050374.35
Cindywood Circle; See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 67.14 FT.

DATE : 05-07-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
67.1	0								
66.6		6" Concrete							
		Very stiff gray LEAN CLAY (CL) w/sand, ferrous stains and ferrous nodules				16			
		-w/oyster shell 6"-7.5"							
63.1				82		17	48	19	29
	5	Very stiff gray SANDY LEAN CLAY (CL) w/sand seams and ferrous nodules				16			
		-stiff to very stiff 6'-10'							
		-w/roots 8'-14'				17			
						16			
	10	-medium stiff to stiff 10'-12'							
		-stiff 12'-14'		66	111	18	30	16	14
		-stiff to very stiff 13'-15'				18			
52.1	15					18			
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 15.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-31

LOG OF BORING NO. GB-32

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13842785.19, E 3050359.24
Caralcrest Drive; See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 18.0 FT.

SURFACE ELEVATION : 67.94 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 18.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
67.9	0								
67.4		7" Concrete							
		Very stiff gray and yellowish brown LEAN CLAY (CL) w/sand and ferrous stains				19			
						14			
	5	-w/sand seams 1'-10'							
		-w/calcareous nodules 3'5"-6'		82	117	14	34	17	17
		-w/ferrous stains 4'-10'							
		-stiff to very stiff 6'-8'				13			
		-gray 6'-10'							
		-medium stiff to very stiff 8'-10'				14			
57.9	10								
		Medium dense gray SANDY SILT (ML) w/lean clay seams	16	50		11			
55.9									
		Very stiff gray and yellowish brown LEAN CLAY (CL) w/sand, ferrous nodules and ferrous stains		80	117	17	41	16	25
	15	-stiff to very stiff 14'-16'				15			
		-very stiff to hard 16'-18'							
49.9						16			
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 18.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-32

LOG OF BORING NO. GB-33

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13842469.02, E 3050530.51
Kellywood Lane; See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 14.0 FT.

SURFACE ELEVATION : 68.84 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
68.8	0								
68.3		6" Concrete							
		Very stiff gray and yellow FAT CLAY (CH) w/ferrous nodules and ferrous stains -w/calcareous nodules 2'-4'				19			
64.8						18			
	5	Stiff to very stiff gray SANDY LEAN CLAY (CL) w/sand seams, ferraus nodules and ferrous stains				19			
						18			
	10	-stiff 10'-12'		66	116	14	31	15	16
		-medium stiff to stiff 12'-14'				17			
54.8						16			
	15								
	20								
	25								
	30								
	35								

SAMPLES

SYMBOL

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-33

LOG OF BORING NO. GB-34

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13841932.22, E 3050082.07
River Forest Drive; See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 68.39 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
68.4	0								
67.9		6" Concrete							
		Very stiff to hard gray LEAN CLAY (CL) w/sand, ferrous nodules and ferrous stains				12			
		-w/roots 6"-2'				11			
	5	-hard 2'-8'							
		-gray and brown 2'-15'				12			
		-w/calcareous nodules 4'-12'				14			
						16			
	10	-stiff to very stiff 10'-12'							
		-stiff 12'-13'		71	117	17	42	18	24
		-medium stiff to stiff 13'-15'				19			
53.4	15					19			
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 15.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-34

LOG OF BORING NO. GB-35

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13842119.32, E 3050487.34
River Forest Drive; See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 68.74 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
68.7	0	6.5" Concrete over 3" Sand							
67.9		Hard gray and yellowish brown LEAN CLAY (CL) w/sand and ferrous stains -w/roots 9.5"-1'				16			
						14			
	5	-w/calcareous nodules 6'-8' -very stiff to hard 6'-10' -gray 6'-12' -w/ferrous nodules 8'-12'				15			
						12			
	10	-very stiff 10'-12'		78	117	13	31	16	15
56.7		Medium dense gray SANDY SILT (ML)				14			
55.2			14	56		13			
53.7	15	Stiff to very stiff gray and brown SANDY LEAN CLAY (CL) w/ferrous stains and ferrous nodules				19			
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 15.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-35

LOG OF BORING NO. GB-36 (GB-36P)

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13841495.30, E 3050236.19
Heatherfield Drive; See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 14.0 FT.

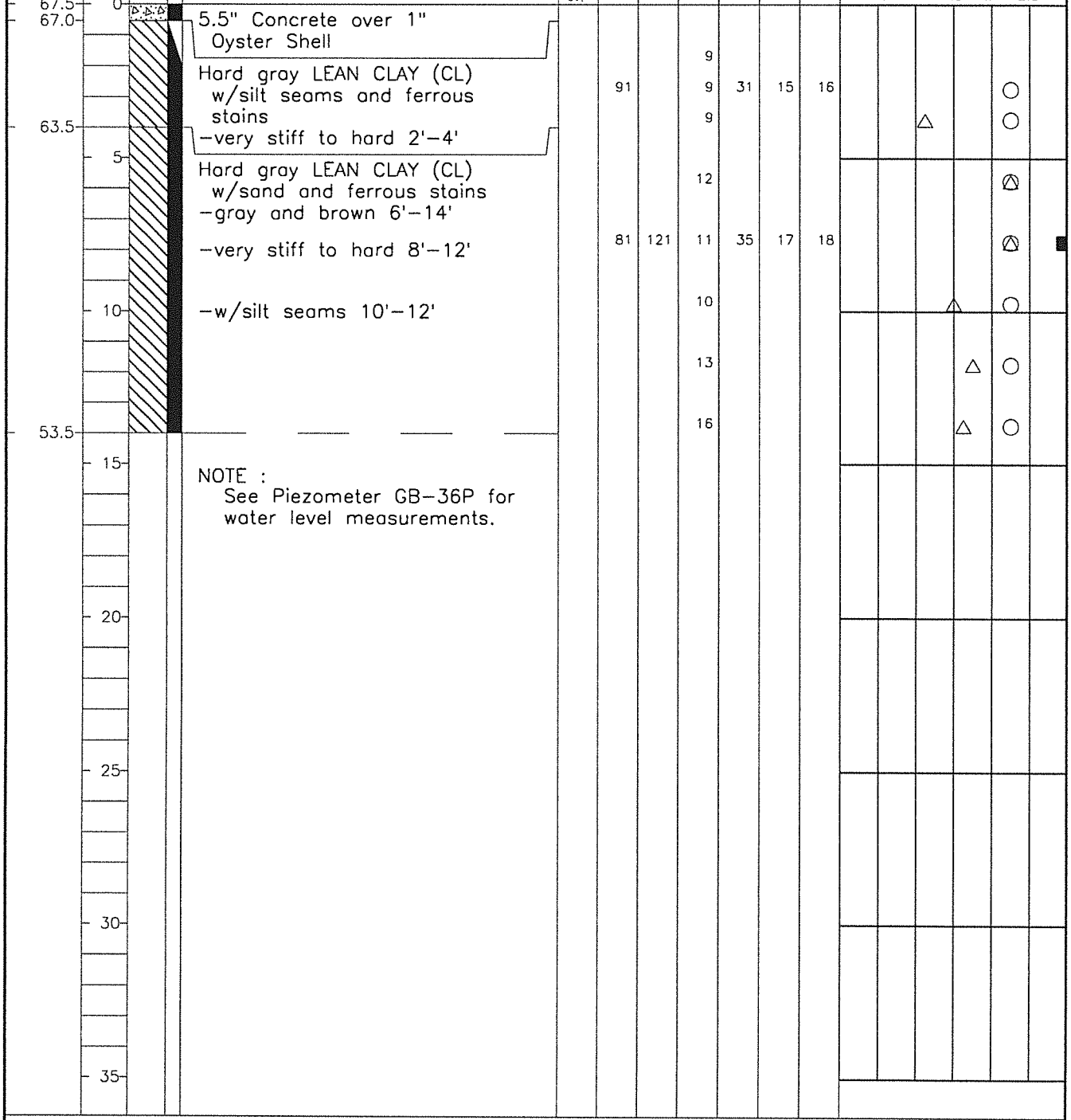
SURFACE ELEVATION : 67.50 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
67.5	0								
67.0		5.5" Concrete over 1" Oyster Shell				9			
		Hard gray LEAN CLAY (CL) w/silt seams and ferrous stains		91		9	31	15	16
63.5		-very stiff to hard 2'-4'				9			
	5	Hard gray LEAN CLAY (CL) w/sand and ferrous stains -gray and brown 6'-14'				12			
		-very stiff to hard 8'-12'		81	121	11	35	17	18
	10	-w/silt seams 10'-12'				10			
						13			
53.5						16			
	15	NOTE : See Piezometer GB-36P for water level measurements.							
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5



DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
NO GROUNDWATER ENCOUNTERED, HOLE OPEN TO 14.0 FT. ON 06-08-13.

Geotest Engineering, Inc.

FIGURE A-36

LOG OF BORING NO. GB-37

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13841794.36, E 3050560.07
Heatherfield Drive; See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 14.0 FT.

SURFACE ELEVATION : 68.24 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 14.0 FT.
WET ROTARY : -- TO -- FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
68.2	0			6.5" Concrete over 3" Oyster Shell							
67.4				Medium stiff to stiff gray LEAN CLAY (CH) w/sand seams and ferrous stains -very stiff to hard 2'-6'				22			
	5							20			
62.2				Stiff to hard gray and yellowish brown LEAN CLAY (CL) w/sand, ferrous nodules and ferrous stains -stiff to very stiff 8'-10' -very stiff to hard 10'-14'		95		18	44	20	24
								16			
	10					72	117	15	34	16	18
								14			
54.2								15			
	15										
	20										
	25										
	30										
	35										

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 14.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-37

LOG OF BORING NO. GB-38

PROJECT : COH Water Line Replacement in Kickerilla Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13841480.11, E 3049425.92
Rancho Bauer Dr.; See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 70.91 FT.

DATE : 05-08-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
70.9	0	12" Asphalt							
69.9		Very stiff gray and reddish brown LEAN CLAY (CL) w/ferrous nodules and ferrous stains				19			
	5	-stiff 2'-6'				25			
						22			
						17			
	10	-very stiff to hard 10'-12'		88	114	17	47	18	29
						16			
		-w/sand pockets 14'-15'				16			
55.9	15					14			
	20								
	25								
	30								
	35								

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 15.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-38

LOG OF BORING NO. GB-39

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13841997.23, E 3049446.47
Rancho Bauer Drive; See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 71.64 FT.

DATE : 05-08-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
71.6	0	12" Asphalt							
70.6		Stiff dark gray LEAN CLAY (CL) w/ferrous nodules and ferrous stains -very stiff 2'-4' -w/vertical sand seams 2'-6' -very stiff to hard 4'-6'				17			
	5					16			
		-very stiff 6'-8'				15			
63.6		Very stiff to hard yellowish brown and gray FAT CLAY (CH) w/sand seams and ferrous nodules -very stiff 10'-14'				16			
	10					16			
				88	108	17	51	21	30
		-stiff to very stiff 14'-15'				16			
56.6	15					18			
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 15.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-39

LOG OF BORING NO. GB-40

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13842530.31, E 3049419.47
Rancho Bauer Drive; See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 70.91 FT.

DATE : 05-08-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
70.9	0	12" Asphalt							
69.9		Very stiff brown and gray LEAN CLAY (CL) w/sand, ferrous stains and ferrous nodules				28			
		-very stiff to hard 2'-8'				17			
	5	-yellow and gray w/vertical sand seams 4'-6'				15			
						15			
	10			81	112	17	42	17	25
		-stiff 12'-14'				15			
						20			
55.9	15	-medium stiff to stiff very sandy clay 14'-15'				18			
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 15.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-40

LOG OF BORING NO. GB-41

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13842978.92, E 3049396.04
Rancho Bauer Drive; See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 20.0 FT.

SURFACE ELEVATION : 71.74 FT.

DATE : 05-08-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 20.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
71.7	0	14" Asphalt							
70.6		Very stiff dark gray LEAN CLAY (CL) w/sand, ferrous stains and ferrous nodules -hard 2'-6'				14			
	5					14			
65.7		Very stiff to hard gray and brown FAT CLAY (CH) w/sand seams, ferrous stains ond ferrous nodules -very stiff 8'-10' -stiff to very stiff 10'-20'				14			
						16			
	10			87	113	16	59	23	36
						20			
						21			
	15			85	109	20	59	23	36
						20			
51.7	20					23			
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 20.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-41

LOG OF BORING NO. GB-42

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843502.85, E 3049369.83
Rancho Bauer Drive; See Plan of Borings (Figure 2.3)

COMPLETION DEPTH : 20.0 FT.

SURFACE ELEVATION : 71.19 FT.

DATE : 05-08-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 20.0 FT.
WET ROTARY : -- TO -- FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
71.2	0			12" Asphalt							
70.2				Very stiff dark gray LEAN CLAY (CL) w/sand and ferrous stains -w/grass roots 1'-4' -hard 2'-6'				13			
	5							12			
65.2				Hard yellowish gray and brown FAT CLAY (CH) w/calcareous and ferrous nodules and ferrous stains -very stiff to hard 8'-12'		83	114	12	47	20	27
	10							15			
								16			
								17			
				-very stiff 14'-16'				17			
	15			-stiff to very stiff 16'-18'		87	109	19	55	20	35
				-very stiff 18'-20'				20			
51.2	20							19			
	25										
	30										
	35										

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 20.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-42

LOG OF BORING NO. GB-43

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843985.76, E 3049344.49
Rancho Bauer Drive; See Plan of Borings (Figure 2.3)

COMPLETION DEPTH : 20.0 FT.

SURFACE ELEVATION : 72.45 FT.

DATE : 05-08-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 20.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
72.4	0	12" Asphalt over 4" Shell Base							
71.1		Very stiff dork gray LEAN CLAY (CL) w/sand and ferrous stains				14			
		-very stiff to hard 2'-4'				14			
	5	-stiff to very stiff 4'-6'							
		-w/calcareous nodules 4'-20'		77	115	15	46	20	26
		-w/vertical sand seams 6'-10'				12			
		-w/ferrous nodules 8'-12'							
	10	-stiff yellow and gray 10'-14'				14			
						19			
58.4						21			
	15	Medium stiff to stiff gray and brown SANDY LEAN CLAY (CL) w/ferrous stains		65	109	19	28	13	15
54.4						19			
52.4	20	Very stiff gray and reddish brown FAT CLAY (CH) w/calcareous nodules and ferrous stains				20			
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 20.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-43

LOG OF BORING NO. GB-44

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13844503.54, E 3049319.70
Rancho Bauer Drive; See Plan of Borings (Figure 2.3)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 78.45 FT.

DATE : 05-07-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
78.4	0			12" Asphalt							
77.4				Dark gray SANDY LEAN CLAY (CL) w/roots and sand seams				12			
76.4				Hard dark gray FAT CLAY (CH) w/sand and ferrous stains -hard w/ferrous nodules 2'-8' -w/calcareous nodules 4'-8'				18			
	5							13			
70.4				-yellow and gray 6'-8'		74	122	13	52	21	31
	10			Hard gray and reddish brown FAT CLAY (CH) w/ferrous stains and calcareous nodules -medium stiff to stiff 10'-12' -very stiff to hard 12'-15'				20			
						89		30	73	29	44
								23			
63.4	15							23			
	20										
	25										
	30										
	35										

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 15.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-44

LOG OF BORING NO. GB-45

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13842407.41, E 3049986.91
White Wing Lane; See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 69.55 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
69.6	0	12" Asphalt							
68.6		Medium stiff to stiff gray LEAN CLAY (CL) w/sand and ferrous stains				15			
	5	-stiff 3'-9'				17			
		-w/ferrous nodules and ferrous stains 4'-15'				18			
		-stiff to very stirff 9'-13'		85	107	19	32	15	17
	10					18			
		-stiff 13'-15'				18			
54.6	15					19			
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 15.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-45

LOG OF BORING NO. GB-46

PROJECT : COH. Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13842914.11, E 3049943.69
White Wing Lane; See Plan of Borings (Figure 2.2)

COMPLETION DEPTH : 20.0 FT.

SURFACE ELEVATION : 69.75 FT.

DATE : 05-07-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 20.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
69.8	0	10.5" Asphalt							
68.9		FILL: medium stiff to stiff brown and gray fat clay w/sand seams				22			
		-medium dense brown sand 2'-4'	21			14			
	5	-clay and sand mix 4'-6'				25			
63.8		Stiff to very stiff gray and brown FAT CLAY (CH) w/ferrous nodules and ferrous stains		87	108	20	54	22	32
		-very stiff 8'-10'				17			
	10	-w/sand seams 8'-14'							
		-stiff 12'-14'				20			
55.8						19			
		Stiff to very stiff gray and yellowish brown LEAN CLAY (CL) w/sand and silt seams		89	110	18	49	19	30
	15	-very stiff 16'-18'							
		-very stiff to hard 18'-20'				22			
49.8	20					16			
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 20.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-46

LOG OF BORING NO. GB-47

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843409.84, E 3049930.89
White Wing Lane; See Plan of Borings (Figure 2.3)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 70.79 FT.

DATE : 05-07-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
70.8	0	12" Asphalt							
69.8		Stiff to very stiff gray and brown LEAN CLAY (CL) w/calcareous nodules				19			
		-very stiff 2'-6'				19			
		-gray 2'-12'							
	5	-w/ferrous nodules 4'-15'				19			
		-very stiff 8'-10'				19			
						20			
	10	-gray and brown w/sand and silt seams 12'-15'		90	107	21	49	21	28
						20			
55.8	15					22			
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 15.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-47

LOG OF BORING NO. GB-48

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13843798.31, E 3050037.51
White Wing Lone; See Plan of Borings (Figure 2.3)

COMPLETION DEPTH : 20.0 FT.

SURFACE ELEVATION : 71.20 FT.

DATE : 05-07-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 20.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
71.2	0	12" Asphalt							
70.2		FILL: very stiff gray fat clay w/sand -medium dense brown silty sand 2'-6'	17			18 10			
	5	-stiff w/vertical sand seams and roots 6'-8'	22	19		13 25			
63.2		Stiff to very stiff gray FAT CLAY (CH) w/calcareous and ferrous nodules and ferrous stains -very stiff 10'-14' -gray and yellowish brown 10'-18'		90	110	20 23	58	23	35
	10	-slickensided 14'-16'				21			
	15	-very stiff 16'-18'			108	20 20			
53.2		Stiff to very stiff gray and yellowish brown SANDY LEAN CLAY (CL) w/sand and silt seams		68		18	37	16	21
51.2	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 20.0 FT. AT END OF DRILLING.

Geotest Engineering, Inc.

FIGURE A-48

LOG OF BORING NO. GB-49 (GB-49P)

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13844278.18, E 3050013.93
White Wing Lane; See Plan of Borings (Figure 2.3)

COMPLETION DEPTH : 20.0 FT.

SURFACE ELEVATION : 72.30 FT.

DATE : 05-06-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 20.0 FT.
WET ROTARY : -- TO -- FT.

UNDRAINED SHEAR STRENGTH, TSF
○ HAND PENETROMETER
● UNCONFINED COMPRESSION
■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
△ TORVANE
0.5 1.0 1.5 2.0 2.5

ELEVATION, FEET	DEPTH, FEET	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
72.3	0			10.5" Asphalt over 1.5" Gravel and Sand Mix							
71.3				Medium stiff to stiff gray LEAN CLAY (CL) w/sand, ferrous stains and ferrous nodules				18			
				-stiff 2'-4'				20			
	5			-stiff to very stiff 4'-8'		72	117	16	49	19	30
				-w/calcareous nodules 4'-12'				18			
				-gray and brown 4'-12'							
				-stiff 8'-10'				20			
	10			-very stiff 10'-12'							
60.3				Very stiff gray and brown FAT CLAY (CH) w/sand, ferrous nodules and ferrous stains				16			
						83	118	15	51	21	30
	15			-stiff to very stiff 16'-18'				22			
				-very stiff to hard reddish brown and gray, slickensided 18'-20'				22			
52.3	20							23			
				NOTE : See Piezometer GB-49P for water level measurements.							
	25										
	30										
	35										

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
▼: WATER DEPTH AT 5.7 FT., HOLE OPEN TO 20.0 FT. ON 06-08-13.

Geotest Engineering, Inc.

FIGURE A-49

LOG OF BORING NO. GB-50

PROJECT : COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas

PROJECT NO. : 1140194601

LOCATION : N 13844731.14, E 3049992.74
White Wing Lane; See Plan of Borings (Figure 2.3)

COMPLETION DEPTH : 15.0 FT.

SURFACE ELEVATION : 74.90 FT.

DATE : 05-07-13

SAMPLER : Shelby Tube/Split Spoon
DRY AUGER : 0.0 TO 15.0 FT.
WET ROTARY : -- TO -- FT.

ELEVATION, FEET	DEPTH, FEET	DESCRIPTION OF MATERIAL	STANDARD PENETRATION TEST, BLOWS PER FOOT	PERCENT PASSING NO. 200 SIEVE	DRY UNIT WEIGHT, PCF	NATURAL MOISTURE CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX, %
74.9	0	12.5" Asphalt							
73.9		Stiff gray and yellow SANDY LEAN CLAY (CL) w/sand seams				27			
		-stiff to very stiff 2'-4'				18			
	5	-w/ferrous nodules and ferrous stains 2'-15'				16			
		-very stiff 4'-10'				15			
						15			
	10	-stiff to very stiff 10'-12'							
		-w/calcareous nodules 10'-15'		70	118	16	40	16	24
		-very stiff 12'-15'				15			
59.9	15					16			
	20								
	25								
	30								
	35								

UNDRAINED SHEAR STRENGTH, TSF
- ○ HAND PENETROMETER
- ● UNCONFINED COMPRESSION
- ■ UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION
- △ TORVANE

0.5 1.0 1.5 2.0 2.5

DEPTH TO WATER IN BORING :
NO GROUNDWATER ENCOUNTERED DURING DRILLING.
HOLE OPEN TO 15.0 FT. AT END OF DRILLING.

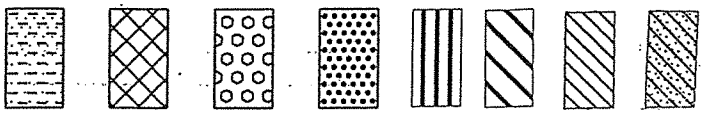
Geotest Engineering, Inc.

FIGURE A-50

Job No. 1140194601

SYMBOLS AND TERMS USED ON BORING LOGS

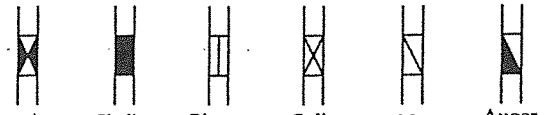
SOIL TYPES
(SHOWN IN SYMBOL COLUMN)



Asphaltic Concrete | Fill | Gravel | Sand | SILT | CLAY | LEAN CLAY | Sandy LEAN CLAY

Predominant type shown heavy

SAMPLER TYPES
(SHOWN IN SAMPLES COLUMN)



Pitcher Barrel | Nx Core | Shelby Tube | Piston | Split Spoon | No Recovery | Auger

TERMS DESCRIBING CONSISTENCY OR CONDITION

Basic Soil Type	Density or Consistency	Standard Penetration Resistance, (1) Blows/ft.	Unconfined Compressive Strength (q_u), (2) Tons/sq. ft.
Cohesionless	Very loose	Less than 4	Not applicable
	Loose	4 to <10	Not applicable
	Medium dense	10 to <30	Not applicable
	Dense	30 to <50	Not applicable
	Very dense	50 or greater	Not applicable
Cohesive	Very soft	Less than 2	Less than 0.25
	Soft	2 to <4	0.25 to <0.5
	Firm/Medium stiff	4 to <8	0.5 to <1.0
	Stiff	8 to <15	1.0 to <2.0
	Very stiff	15 to <30	2.0 to <4.0
	Hard	30 or greater	4 or greater

(1) Number of blows from 140-lb. weight falling 30-in. to drive 2-in. OD, 1-3/8-in. ID, split barrel sampler (ASTM D1586)

(2) q_u may also be approximated using a pocket penetrometer

TERMS CHARACTERIZING SOIL STRUCTURE

Parting: -paper thin in size Seam: -1/8" to 3" thick Layer: -greater than 3"

Slickensided	- having inclined planes of weakness that are slick and glossy in appearance.
Fissured	- containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
Laminated	- composed of thin layers of varying color and texture.
Interbedded	- composed of alternate layers of different soil types.
Calcareous	- containing appreciable quantities of calcium carbonate.
Well graded	- having wide range in grain sizes and substantial amounts of all intermediate particle sizes.
Poorly graded	- predominantly of one grain size, or having a range of sizes with some intermediate size missing.
Flocculated	- pertaining to cohesive soils that exhibit a loose knit or flakey structure.

Job No. 1140194601

PIEZOMETER INSTALLATION REPORT

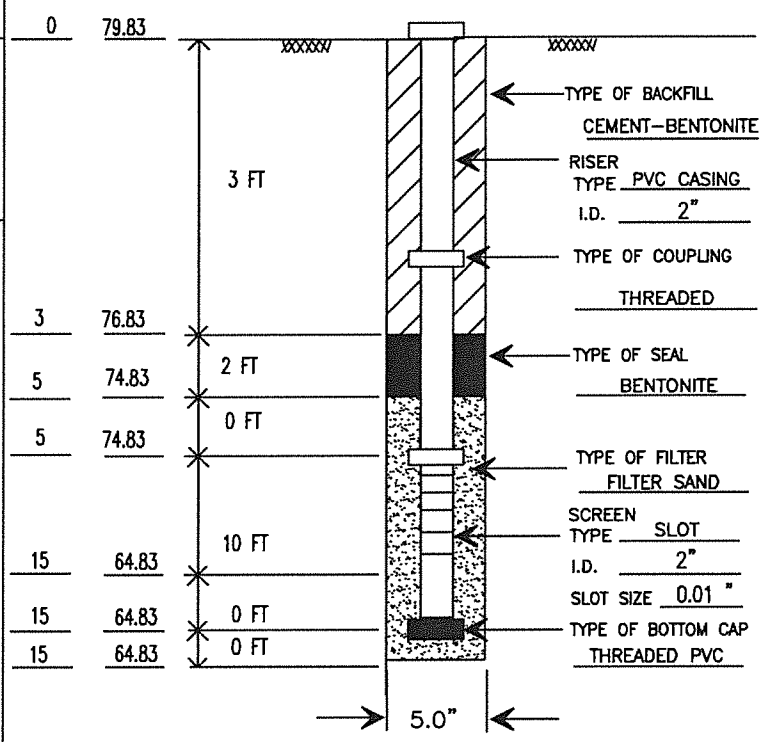
PROJECT NAME: COH Water Line Replacement on Kickerillo Area WBS No. S-000035-01185-3	PIEZOMETER NUMBER: GB-1P
GEOTECHNICAL CONSULTANT GEOTEST ENGINEERING, INC.	DESIGN CONSULTANT JCI
	HOUSTON, TEXAS

COMPLETION DATE 5-06-13
DRY AUGERED 0 TO 15 FT
WASH BORED ____ TO ____ FT
DRILLING FLUID: WATER

DEVELOPMENT DATE: 5-06-13
METHOD OF DEVELOPMENT:
BAILING

WATER LEVEL READINGS:

DATE	DEPTH (TOG)	ELEVATION
5-7-13	11.7	68.13
6-8-13	11.3	68.53



(NOT TO SCALE)

REMARKS:

NOTES:
1. DIMENSIONS NOMINAL UNLESS OTHERWISE NOTED
2. TOG = TOP OF GROUND

DRILLED BY: DG	STARTED: 5-6-13	NORTHING: 13844243.94 EASTING: 3046683.66
LOGGED BY: TM	COMPLETED: 5-6-13	GROUND LEVEL (MSL): 79.83
CHECKED BY: NK	APPROVED BY: MB	SHEET 1 OF 1

Job No. 1140194601

PIEZOMETER INSTALLATION REPORT

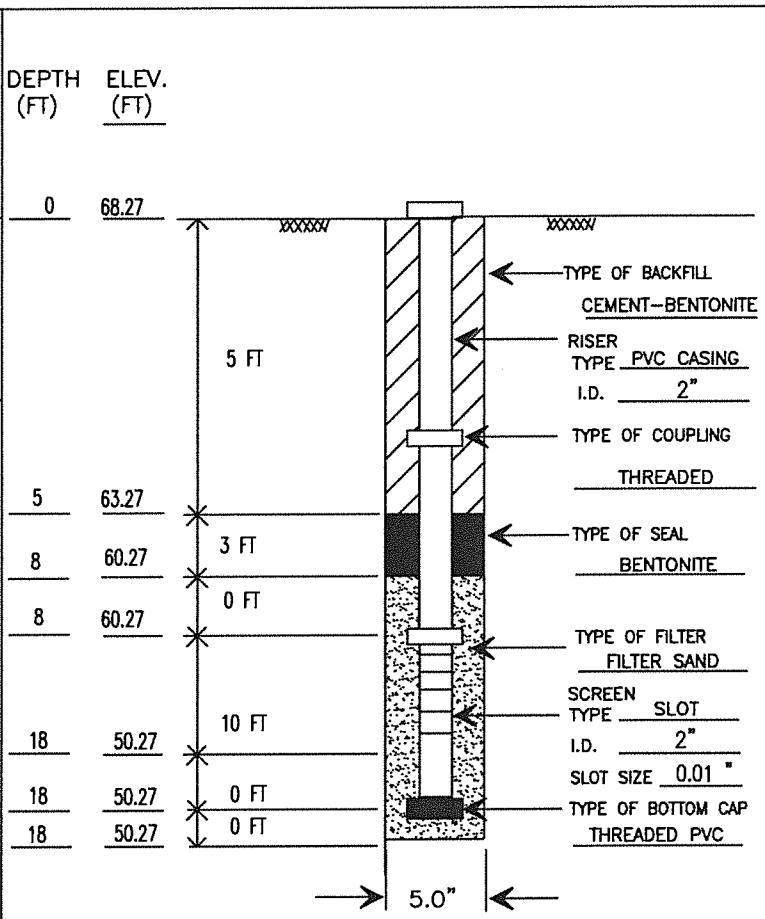
PROJECT NAME: COH Water Line Replacement on Kickerillo Area WBS No. S-000035-0185-3		PIEZOMETER NUMBER: GB-22P
GEOTECHNICAL CONSULTANT GEOTEST ENGINEERING, INC.	DESIGN CONSULTANT JCI	HOUSTON, TEXAS

COMPLETION DATE 5-06-13
DRY AUGERED 0 TO 12.0 FT
WASH BORED 12.0 TO 18.0 FT
DRILLING FLUID: WATER

DEVELOPMENT DATE: 5-06-13
METHOD OF DEVELOPMENT:
BAILING

WATER LEVEL READINGS:

DATE	DEPTH (TOG)	ELEVATION
5-7-13	8.2	60.07
6-8-13	4.7	63.57



(NOT TO SCALE)

REMARKS:

NOTES:
1. DIMENSIONS NOMINAL UNLESS OTHERWISE NOTED
2. TOG = TOP OF GROUND

DRILLED BY: DG	STARTED: 5-6-13	NORTHING: 13842946.14 EASTING: 3048243.63
LOGGED BY: TM	COMPLETED: 5-6-13	GROUND LEVEL (MSL): 68.27
CHECKED BY: NK	APPROVED BY: MB	SHEET 1 OF 1

Job No. 1140194601

PIEZOMETER INSTALLATION REPORT

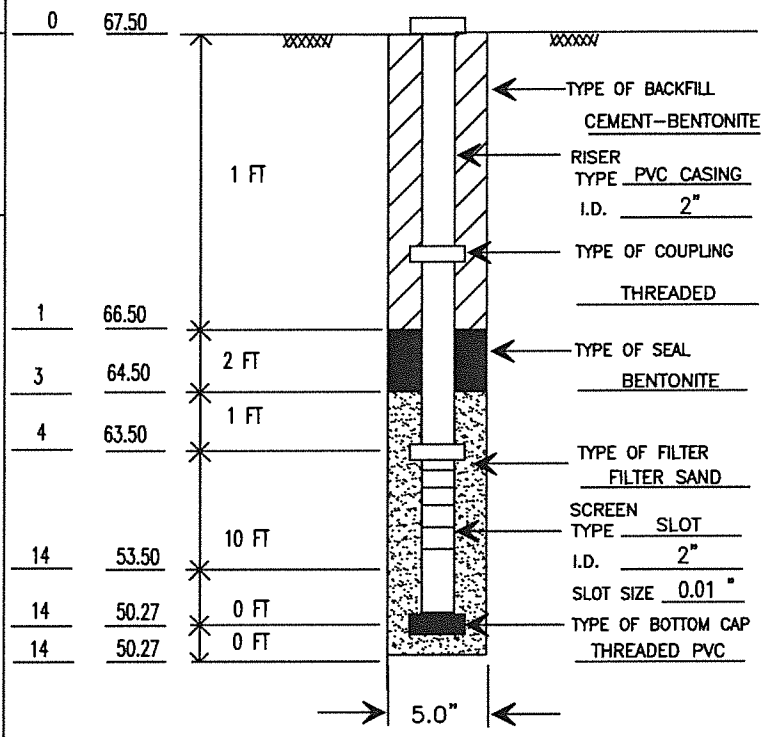
PROJECT NAME: COH Water Line Replacement on Kickerillo Area WBS No. S-000035-0185-3	PIEZOMETER NUMBER: GB-36P
GEOTECHNICAL CONSULTANT GEOTEST ENGINEERING, INC.	DESIGN CONSULTANT JCI
	HOUSTON, TEXAS

COMPLETION DATE 5-06-13
DRY AUGERED 0 TO 14.0 FT
WASH BORED ____ TO ____ FT
DRILLING FLUID: WATER

DEVELOPMENT DATE: 5-06-13
METHOD OF DEVELOPMENT:
BAILING

WATER LEVEL READINGS:

DATE	DEPTH (TOG)	ELEVATION
5-7-13	DRY	
6-8-13	DRY	



(NOT TO SCALE)

REMARKS:

NOTES:
1. DIMENSIONS NOMINAL UNLESS OTHERWISE NOTED
2. TOG = TOP OF GROUND

DRILLED BY: DG	STARTED: 5-6-13	NORTHING: 13841495.30 EASTING: 3050236.19
LOGGED BY: TM	COMPLETED: 5-6-13	GROUND LEVEL (MSL): 67.50
CHECKED BY: NK	APPROVED BY: MB	SHEET 1 OF 1

Job No. 1140194601

PIEZOMETER INSTALLATION REPORT

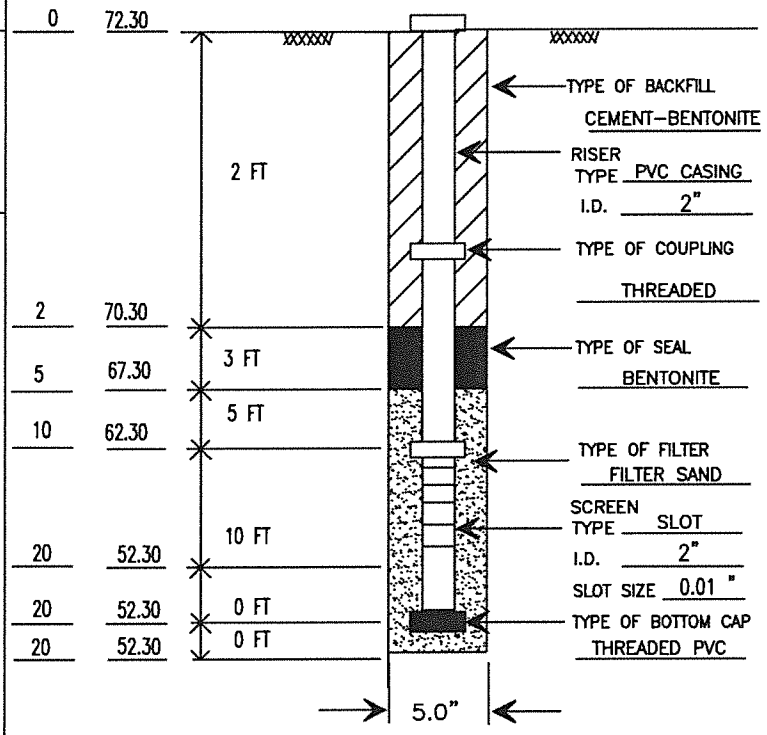
PROJECT NAME: COH Water Line Replacement on Kickerillo Area WBS No. S-000035-0185-3		PIEZOMETER NUMBER: GB-49P
GEOTECHNICAL CONSULTANT GEOTEST ENGINEERING, INC.	DESIGN CONSULTANT JCI	HOUSTON, TEXAS

COMPLETION DATE 5-06-13
DRY AUGERED 0 TO 20.0 FT
WASH BORED ____ TO ____ FT
DRILLING FLUID: WATER

DEVELOPMENT DATE: 5-06-13
METHOD OF DEVELOPMENT:
BAILING

WATER LEVEL READINGS:

DATE	DEPTH (TOG)	ELEVATION
5-7-13	5.7	66.60
6-8-13	5.7	66.60



(NOT TO SCALE)

REMARKS:

NOTES:
1. DIMENSIONS NOMINAL UNLESS OTHERWISE NOTED
2. TOG = TOP OF GROUND

DRILLED BY: DG	STARTED: 5-6-13	NORTHING: 13844278.18 EASTING: 3050013.93
LOGGED BY: TM	COMPLETED: 5-6-13	GROUND LEVEL (MSL): 72.30
CHECKED BY: NK	APPROVED BY: MB	SHEET 1 OF 1

APPENDIX B

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-1 (GB-1P)	2	0.5	2.0	UD		15									1.13	2.25	Lean Clay
	3	2.0	4.0	UD		12									1.50	2.25	Lean Clay
	4	4.0	6.0	UD		12	122	43	16	27	72		2.72	0.43	2.00	2.25	Lean Clay
	5	6.0	8.0	UD		21									1.75	2.25	Lean Clay
	6	8.0	10.0	UD		23	103	71	26	45	93		1.75	0.72	1.75	2.25	Fat Clay
	7	10.0	12.0	UD		23									1.88	2.25	Fat Clay
	8	12.0	14.0	UD		29									1.75	2.25	Fat Clay
	9	14.0	15.0	UD		23									2.00	2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-1

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-2	2	0.5	2.0	UD		16									1.00	1.50	Lean Clay
	3	2.0	4.0	UD		16									1.13	1.38	Lean Clay
	4	4.0	6.0	UD		15									1.50	1.75	Lean Clay
	5	6.0	8.0	UD		19	108	44	16	28	79		0.87	0.58	1.25	1.13	Lean Clay
	6	8.0	10.0	UD		19									1.25	1.13	Lean Clay
	7	10.0	12.0	UD		30									1.25	1.75	Fat Clay
	8	12.0	14.0	UD		17									0.63	1.63	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-2

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-3	2	0.5	2.0	UD		13									0.75	1.25	Sandy Lean Clay
	3	2.0	4.0	UD		13									1.75	2.25	Sandy Lean Clay
	4	4.0	6.0	UD		14		42	14	28	70				1.50	1.75	Sandy Lean Clay
	5	6.0	8.0	UD		15									1.00	1.75	Sandy Lean Clay
	6	8.0	10.0	UD		17									0.75	1.50	Sandy Lean Clay
	7	10.0	12.0	UD		25	103	59	23	36	87		1.30	0.86	1.50	1.50	Fat Clay
	8	12.0	14.0	UD		31									1.50	1.63	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-3

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-4	2	0.5	2.0	UD		15									1.13	1.50	Lean Clay
	3	2.0	4.0	UD		17									0.88	1.13	Lean Clay
	4	4.0	6.0	UD		22	112	46	20	26	79		1.12	0.43	1.25	1.25	Lean Clay
	5	6.0	8.0	UD		24									1.50	1.50	Fat Clay
	6	8.0	10.0	UD		25		63	24	39	98				2.00	2.00	Fat Clay
	7	10.0	12.0	UD		18									2.00	2.00	Fat Clay
	8	12.0	14.0	UD		21									2.25	2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-4

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-5	2	0.5	2.0	UD		23									0.75	0.88	Fat Clay
	3	2.0	4.0	UD		20		52	21	31	87				0.80	0.88	Fat Clay
	4	4.0	6.0	UD		19									1.00	1.00	Fat Clay
	5	6.0	8.0	UD		19									1.00	0.75	Fat Clay
	6	8.0	10.0	UD		21	105	55	22	33	97		0.71	0.72	1.00	1.13	Fat Cloy
	7	10.0	12.0	UD		22									2.00	2.25	Fat Clay
	8	12.0	14.0	UD		20									2.00	2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetrotion Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-5

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-6	2	0.5	2.0	UD		20									1.00	0.88	Lean Clay
	3	2.0	4.0	UD		20	104	49	19	30	76		0.58	0.29	0.80	0.88	Lean Clay
	4	4.0	6.0	UD		18									1.25	1.13	Lean Clay
	5	6.0	8.0	UD		18									1.25	1.00	Lean Clay
	6	8.0	10.0	UD		25	102	64	25	39	91		0.78	0.72	1.25	1.25	Fat Clay
	7	10.0	12.0	UD		25									2.50	2.25	Fat Clay
	8	12.0	14.0	UD		26									2.50	2.25	Fat Clay
	9	14.0	15.0	UD		22											Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-6

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-7	2	0.5	2.0	UD		12									2.25	2.25	Lean Clay
	3	2.0	4.0	UD		13									2.00	2.25	Lean Clay
	4	4.0	6.0	UD		14		46	20	26	80				2.00	2.25	Lean Clay
	5	6.0	8.0	UD		22									1.75	1.75	Lean Clay
	6	8.0	10.0	UD		25	102	75	28	47	90		1.26	0.72	1.38	1.25	Fat Clay
	7	10.0	12.0	UD		23									1.50	1.63	Fat Clay
	8	12.0	14.0	UD		21									1.13	0.88	Lean Clay
	9	14.0	15.0	UD		22									0.63	1.00	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-7

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-8	2	0.5	2.0	UD		23									0.75	0.63	Fat Clay
	3	2.0	4.0	UD		21									0.75	0.75	Fat Clay
	4	4.0	6.0	UD		20	110	57	17	40	79		1.26	0.43	1.00	1.25	Fat Clay
	5	6.0	8.0	UD		24									1.00	1.13	Fat Clay
	6	8.0	10.0	UD		24									1.00	1.13	Fat Clay
	7	10.0	12.0	UD		23	106	46	21	25	90		1.00	0.86	1.00	1.25	Lean Clay
	8	12.0	14.0	UD		20									1.00	1.75	Lean Clay
	9	14.0	15.0	UD		21									0.75	0.63	Lean Clay

LEGEND: UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-8

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-9	2	0.6	2.0	UD		15											Sandy Lean Clay
	3	2.0	4.0	UD		14									2.50	2.25	Fat Clay
	4	4.0	6.0	UD		13									2.50	2.25	Fat Clay
	5	6.0	8.0	UD		17	111	60	24	36	90		0.93	0.58	0.80	1.00	Fat Clay
	6	8.0	10.0	UD		20									1.50	1.50	Fat Clay
	7	10.0	12.0	UD		19									0.75	0.75	Sandy Lean Clay
	8	12.0	14.0	UD		20					50						Sandy Lean Clay
	9	14.0	15.0	UD		19									0.63	1.75	Sandy Lean Clay
	10	15.5	17.0	SS	27	23											Clayey Silt
	11	17.0	18.0	UD		20	106	27	21	6	91		0.49	1.30	0.63	1.88	Silty Clay
	12	20.0	22.0	UD		18									0.63	1.75	Silty Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-9

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-10	2	0.5	2.0	UD		17									1.25	1.50	Lean Clay
	3	2.0	4.0	UD		16									1.25	1.75	Lean Clay
	4	4.0	6.0	UD		20									1.00	1.25	Lean Clay
	5	6.0	8.0	UD		19									1.00	1.25	Lean Clay
	6	8.0	10.0	UD		22	106	53	22	31	82		0.97	0.72	0.75	0.75	Fat Clay
	7	10.0	12.0	UD		21									1.00	1.13	Fat Clay
	8	12.0	14.0	UD		21									0.60	0.75	Lean Clay
	9	14.0	15.0	UD		23									0.30	0.25	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-10

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blaws/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-11	2	0.8	2.0	UD		14									1.50	2.25	Lean Clay
	3	2.0	4.0	UD		15									1.50	2.25	Lean Clay
	4	4.0	6.0	UD		26	102	61	25	36	84		1.18	0.43	1.25	1.25	Fat Cloy
	5	6.0	8.0	UD		28									0.88	1.00	Fat Clay
	6	8.0	10.0	UD		31									0.88	1.00	Fat Cloy
	7	10.0	12.0	UD		18									1.38	2.00	Lean Clay
	8	12.5	14.0	SS	12	21					66						Sandy Silt
	9	17.5	19.0	SS	100/4.5"	19											Sandy Silt

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-11

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-12	2	0.8	2.0	UD		16									1.13	1.38	Lean Clay
	3	2.0	4.0	UD		17									0.88	1.13	Lean Clay
	4	4.0	6.0	UD		27	101	64	25	39	84		0.62	0.43	0.80	0.88	Fat Clay
	5	6.0	8.0	UD		23									1.50	1.25	Fat Clay
	6	8.0	10.0	UD		21									0.88	1.38	Silty Clay
	7	10.0	12.0	UD		22	114						0.27	0.86	0.20	0.50	Silty Clay
	8	12.0	14.0	UD		19											Clayey Silt

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-12

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-13	2	0.6	2.0	UD		20									0.50	0.25	Fill
	3	2.0	4.0	UD		27									0.40	0.25	Fill
	4	4.0	6.0	UD		19									0.50	0.50	Fill
	5	6.0	8.0	UD		30	100	54	22	32	93		0.95	0.58	1.25	2.00	Fat Clay
	6	8.0	10.0	UD		25									2.00	2.13	Fat Clay
	7	10.0	11.0	UD											1.00	2.00	Lean Clay
	8	11.0	12.0	UD		22									1.00	1.75	Lean Clay
	9	12.0	14.0	UD		21	107	29	20	9	95		0.75	1.01		1.00	Lean Clay
	10	14.0	16.0	UD		22									0.60	0.75	Lean Clay
	11	16.0	17.0	UD		14									0.60	2.25	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-13

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-14	2	0.7	2.0	UD		21									0.50	0.75	Lean Clay
	3	2.0	4.0	UD		19									0.50	0.75	Lean Clay
	4	4.0	6.0	UD		18	112	43	16	27	71		0.67	0.43	1.00	1.25	Lean Clay
	5	6.0	8.0	UD		17									1.00	1.38	Lean Clay
	6	8.0	10.0	UD		20									0.40	0.38	Lean Clay
	7	10.0	12.0	UD		19											Clayey Silt
	8	12.0	14.0	UD		23	96	28	19	9			0.40	1.01	0.50	0.88	Lean Clay
	9	14.0	16.0	UD		23		57	23	34	100				2.00	2.13	Fat Clay
	10	16.0	17.0	UD		24									2.00	2.25	Fat Clay

LEGEND: UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-14

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-15	2	0.5	2.0	UD		16									1.63	1.88	Lean Clay
	3	2.0	4.0	UD		14									1.63	2.13	Lean Clay
	4	4.0	6.0	UD		23									1.25	1.50	Fat Clay
	5	6.0	8.0	UD		20									1.13	2.25	Fat Clay
	6	8.0	10.0	UD		26	104	50	21	29	92		0.93	0.72	1.38	1.25	Fat Clay
	7	10.0	12.0	UD		23									1.00	2.13	Fat Clay
	8	12.0	14.0	UD		20									1.13	1.00	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-15

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-16	2	0.7	2.0	UD		20									0.45	0.88	Lean Clay
	3	2.0	4.0	UD		17									0.65	0.50	Lean Clay
	4	4.0	6.0	UD		20									0.65	0.88	Lean Clay
	5	6.0	8.0	UD		20	111	46	20	26	73		0.73	0.58	1.13	1.13	Lean Clay
	6	8.0	10.0	UD		21									1.00	0.50	Lean Clay
	7	10.0	12.0	UD		20									0.55	0.38	Lean Clay
	8	12.0	14.0	UD		19									0.50	0.38	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-16

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-17	2	0.5	2.0	UD		19									0.88	0.75	Lean Clay
	3	2.0	4.0	UD		18									1.00	0.75	Lean Clay
	4	4.0	6.0	UD		18									0.25	0.88	Lean Clay
	5	6.0	8.0	UD		23									0.63	1.00	Lean Clay
	6	8.0	10.0	UD		21	107	47	20	27	86		1.65	0.72	1.63	1.38	Lean Clay
	7	10.0	12.0	UD		21									1.25	1.13	Lean Clay
	8	12.0	14.0	UD		23									1.00	1.88	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-17

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-18	2	0.6	2.0	UD		17									1.00	1.25	Lean Clay
	3	2.0	4.0	UD		17									1.13	1.25	Lean Clay
	4	4.0	6.0	UD	19	19									1.38	1.13	Lean Clay
	5	6.0	8.0	UD		23									1.00	1.13	Lean Clay
	6	8.0	10.0	UD		19	107	45	19	26	79		0.63	0.72	1.00	0.50	Lean Clay
	7	10.0	12.0	UD		18									1.25	1.38	Lean Clay
	8	12.0	14.0	UD		18									0.65	0.75	Lean Clay
	9	14.5	16.0	SS	19	26					72						Silt
	10	16.0	17.0	UD		27									1.13	2.00	Fat Clay

LEGEND: UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-18

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-19	2	0.4	2.0	UD		19									0.75	1.00	Sandy Lean Clay
	3	2.0	4.0	UD		18									1.00	1.00	Sandy Lean Clay
	4	4.0	6.0	UD		18									1.00	1.00	Sandy Lean Clay
	5	6.0	8.0	UD		19									0.88	0.88	Sandy Lean Clay
	6	8.0	10.0	UD		17	111	42	16	26	62		0.61	0.72	1.00	1.13	Sandy Lean Clay
	7	10.0	12.0	UD		17									1.00	1.38	Sandy Lean Clay
	8	12.0	14.0	UD		16									1.13	1.63	Sandy Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-19

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-20	2	0.8	2.0	UD		14									2.00	2.25	Lean Clay
	3	2.0	4.0	UD		12									1.88	2.25	Lean Clay
	4	4.0	6.0	UD		16									1.50	1.75	Lean Clay
	5	6.0	8.0	UD		19	108	51	17	34	83		0.66	0.58	0.60	0.63	Fat Clay
	6	8.0	10.0	UD		20									0.63	1.00	Fat Clay
	7	10.0	12.0	UD		18									0.40	0.63	Sandy Lean Clay
	8	12.0	13.0	UD		19									0.40	0.88	Sandy Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-20

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-21	2	0.6	2.0	UD		16									1.13	1.13	Lean Clay
	3	2.0	4.0	UD		16									1.00	1.38	Lean Clay
	4	4.0	6.0	UD		17									1.00	1.38	Lean Clay
	5	6.0	8.0	UD		21									0.75	1.00	Fat Clay
	6	8.0	10.0	UD		20	108	52	21	31	76		0.70	0.72	0.75	1.00	Fat Clay
	7	10.0	12.0	UD		18									0.38	1.00	Sandy Lean Clay
	8	12.0	13.0	UD		21									0.30	0.63	Sandy Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-21

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-22 (GB-22P)	2	0.8	2.0	UD		19									0.63	0.63	Lean Clay
	3	2.0	4.0	UD		11									0.40	0.63	Lean Clay
	4	4.0	6.0	UD		17	111	30	15	15	80		0.35	0.43	0.50	0.38	Lean Clay
	5	6.0	8.0	UD		18									0.75	1.00	Lean Clay
	6	8.0	10.0	UD		17									0.45	0.88	Lean Clay
	7	10.0	12.0	UD		23									0.45	0.88	Lean Clay
	8	12.0	14.0	UD		24	102	29	17	12	99		0.45	1.01	0.40	0.88	Lean Clay
	9	14.0	16.0	UD		25									1.75	2.25	Fat Clay
	10	16.0	17.0	UD		26		59	23	36	100				2.25	2.25	Fat Clay
	11	17.0	18.0	UD												2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-22

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-23	2	0.5	2.0	UD		17									1.00	0.88	Lean Clay
	3	2.0	4.0	UD		18									1.00	1.75	Lean Clay
	4	4.0	6.0	UD		15									1.00	2.25	Lean Clay
	5	6.0	8.0	UD		23	105	67	25	42	88		1.99	0.58	1.13	1.25	Fat Clay
	6	8.0	10.0	UD		23									1.25	1.88	Fat Clay
	7	10.0	12.0	UD		26		66	25	41	99				2.50	2.25	Fat Clay
	8	12.0	13.0	UD		22									2.50	2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-23

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-24	2	0.6	2.0	UD		18									1.50	1.63	Sandy Lean Clay
	3	2.0	4.0	UD		15									1.50	1.75	Sandy Lean Clay
	4	4.0	6.0	UD		17	112	41	17	24	70		1.13	0.43	1.25	1.25	Sandy Lean Clay
	5	6.0	8.0	UD		17									0.80	0.88	Sandy Lean Clay
	6	8.0	10.0	UD		23									1.50	1.50	Fat Clay
	7	10.0	12.0	UD		33	88	57	23	34	93		0.33	0.86	0.60	0.75	Fat Clay
	8	12.0	14.0	UD		22									2.00	2.25	Fat Clay

LEGEND: UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-24

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-25	2	0.6	2.0	UD		17									1.00	1.00	Lean Clay
	3	2.0	4.0	UD		14									2.00	2.13	Lean Clay
	4	4.0	6.0	UD		15									2.00	1.75	Lean Clay
	5	6.0	8.0	UD		21	105	65	25	40	86		1.04	0.58	1.25	1.25	Fat Clay
	6	8.0	10.0	UD		22									1.00	1.00	Fat Clay
	7	10.0	12.0	UD		29		69	26	43	96				1.50	1.50	Fat Clay
	8	12.0	14.0	UD		21									2.00	2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-25

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-26	2	0.6	2.0	UD		14									1.50	2.25	Lean Clay
	3	2.0	4.0	UD		14									2.00	2.25	Lean Clay
	4	4.0	6.0	UD		16									1.50	1.88	Lean Clay
	5	6.0	8.0	UD		16									1.88	1.88	Lean Clay
	6	8.0	10.0	UD		16	115	45	19	26	80		1.85	0.72	1.50	1.88	Lean Clay
	7	10.0	12.0	UD		16									1.38	1.25	Lean Clay
	8	12.0	13.0	UD		17									1.00	1.50	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-26

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-27	2	0.5	2.0	UD		19									0.75	1.00	Lean Clay
	3	2.0	4.0	UD		14									1.50	2.00	Lean Clay
	4	4.0	6.0	UD		16									1.63	2.00	Lean Clay
	5	6.0	8.0	UD		19									0.75	1.00	Lean Clay
	6	8.0	10.0	UD		21	106	49	21	28	88		0.86	0.72	0.70	0.88	Lean Clay
	7	10.0	12.0	UD		18									1.00	1.25	Lean Clay
	8	12.0	13.0	UD		20									0.75	0.88	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-27

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-28	2	0.5	2.0	UD		13									0.63	1.00	Lean Clay
	3	2.0	4.0	UD		18									1.00	0.88	Lean Clay
	4	4.0	6.0	UD		16									1.00	1.13	Lean Clay
	5	6.0	8.0	UD		16									1.00	1.13	Lean Clay
	6	8.0	10.0	UD		20	110	49	20	29	76		0.57	0.72	0.75	1.13	Lean Clay
	7	10.0	12.0	UD		19									0.88	1.25	Lean Clay
	8	12.0	14.0	UD		18									0.88	1.25	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-28

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-29	2	1.3	2.0	UD		17									0.88	1.38	Sandy Clay
	3	2.0	4.0	UD		17									1.00	1.13	Sandy Clay
	4	4.0	6.0	UD		16									1.25	1.63	Sandy Clay
	5	6.0	8.0	UD		18	116	46	20	26	66		0.65	0.58	0.88	1.25	Sandy Clay
	6	8.0	10.0	UD		18									1.25	1.50	Sandy Clay
	7	10.0	12.0	UD		16									1.25	1.75	Sandy Clay
	8	12.0	14.0	UD		17									1.00	1.50	Sandy Clay
	9	14.0	16.0	UD		16	116	35	16	19	68		0.73	1.15	0.75	0.75	Sandy Clay
	10	16.0	18.0	UD		17									0.50	1.00	Sandy Clay
	11	18.0	20.0	UD		15									0.50	1.13	Sandy Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-29

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-30	2	0**	2.0	UD		15									2.25	2.25	Lean Clay
	3	2.0	4.0	UD		14									2.25	2.25	Lean Clay
	4	4.0	6.0	UD		15									2.00	2.25	Lean Clay
	5	6.0	8.0	UD		16									2.00	2.25	Lean Clay
	6	8.0	10.0	UD		17									1.75	2.25	Lean Clay
	7	10.0	11.0	UD		18									1.13	1.25	Lean Clay
	8	11.0	13.0	UD		18	109	43	19	24	75		0.76	0.94	1.00	0.88	Lean Clay
	9	13.0	15.0	UD		17									1.00	1.25	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-30

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-31	2	0.5	2.0	UD		16									1.13	1.50	Lean Clay
	3	2.0	4.0	UD		17		48	19	29	82				1.13	1.50	Lean Clay
	4	4.0	6.0	UD		16									1.13	1.50	Sandy Lean Clay
	5	6.0	8.0	UD		17									0.88	1.38	Sandy Lean Clay
	6	8.0	10.0	UD		16									0.63	1.25	Sandy Lean Clay
	7	10.0	12.0	UD		18	111	30	16	14	66		0.41	0.86	0.40	0.88	Sandy Lean Clay
	8	12.0	13.0	UD		18									0.63	0.88	Sandy Lean Clay
	9	13.0	15.0	UD		18									0.50	1.00	Sandy Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-31

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-32	2	0.6	2.0	UD		19									1.38	1.75	Lean Clay
	3	2.0	4.0	UD		14									1.38	1.88	Lean Clay
	4	4.0	6.0	UD		14	117	34	17	17	82		1.52	0.43	1.13	1.75	Lean Clay
	5	6.0	8.0	UD		13									0.50	1.25	Lean Clay
	6	8.0	10.0	UD		14									0.38	1.38	Lean Clay
	7	10.5	12.0	SS	16	11					50						Sandy Silt
	8	12.0	14.0	UD		17	117	41	16	25	80		1.42	1.01	1.25	1.38	Lean Clay
	9	14.0	16.0	UD		15									0.88	1.63	Lean Clay
	10	16.0	18.0	UD		16									1.38	2.00	Lean Clay

LEGEND: UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-32

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-33	2	0.5	2.0	UD		19									1.00	1.00	Fat Clay
	3	2.0	4.0	UD		18									1.13	1.25	Fat Clay
	4	4.0	6.0	UD		19									0.88	1.25	Sandy Leon Clay
	5	6.0	8.0	UD		18									0.88	1.13	Sandy Leon Clay
	6	8.0	10.0	UD		14	116	31	15	16	66		0.85	0.72	0.50	1.13	Sandy Leon Clay
	7	10.0	12.0	UD		17									0.50	0.88	Sandy Leon Clay
	8	12.0	14.0	UD		16									0.35	0.88	Sandy Leon Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-33

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-34	2	0.5	2.0	UD		12									1.13	2.25	Lean Clay
	3	2.0	4.0	UD		11									2.00	2.25	Lean Clay
	4	4.0	6.0	UD		12									2.13	2.25	Lean Clay
	5	6.0	8.0	UD		14									2.00	2.25	Lean Clay
	6	8.0	10.0	UD		16									1.88	2.00	Lean Clay
	7	10.0	12.0	UD		17	117	42	18	24	71		0.93	0.86	0.88	1.38	Lean Clay
	8	12.0	13.0	UD		19									0.75	0.88	Lean Clay
	9	13.0	15.0	UD		19									0.45	0.63	Lean Clay

LEGEND: UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-34

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-35	3	0.8	2.0	UD		16									2.25	2.25	Lean Clay
	4	2.0	4.0	UD		14									2.25	2.25	Lean Clay
	5	4.0	6.0	UD		15									2.25	2.25	Lean Clay
	6	6.0	8.0	UD		12									1.88	2.25	Lean Clay
	7	8.0	10.0	UD		13	117	31	16	15	78		1.52	0.72	1.13	2.25	Lean Clay
	8	10.0	12.0	UD		14									1.13	1.75	Lean Clay
	9	12.0	13.5	SS	14	13					56						Sandy Silt
	10	13.5	15.0	UD		19									0.75	1.13	Sandy Lean Clay

LEGEND: UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-35

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
CB-36 (CB-36P)	3	0.5	2.0	AG		9											Lean Clay
	4	2.0	3.0	UD		9		31	15	16	91					2.25	Lean Clay
	5	3.0	4.0	UD		9									1.13	2.25	Lean Clay
	6	4.0	6.0	UD		12									2.25	2.25	Lean Clay
	7	6.0	8.0	UD		11	121	35	17	18	81		2.94	0.58	2.25	2.25	Lean Clay
	8	8.0	10.0	UD		10									1.50	2.25	Lean Clay
	9	10.0	12.0	UD		13									1.75	2.25	Lean Clay
	10	12.0	14.0	UD		16									1.63	2.25	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-36

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-37	2	0.8	2.0	UD		22									0.35	0.50	Lean Clay
	3	2.0	4.0	UD		20									1.00	2.00	Lean Clay
	4	4.0	6.0	UD		18		44	20	24	95				1.50	2.25	Lean Clay
	5	6.0	8.0	UD		16									0.75	2.25	Lean Clay
	6	8.0	10.0	UD		15	117	34	16	18	72		0.96	0.72	0.88	1.63	Lean Clay
	7	10.0	12.0	UD		14									1.25	2.00	Lean Clay
	8	12.0	14.0	UD		15									1.25	2.00	Lean Clay

LEGEND:
UO = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-37

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-38	2	1.0	2.0	UD		19									1.25	1.13	Lean Clay
	3	2.0	4.0	UD		25									0.63	0.88	Lean Clay
	4	4.0	6.0	UD		22									0.50	0.63	Lean Clay
	5	6.0	8.0	UD		17									1.25	1.38	Lean Clay
	6	8.0	10.0	UD		17	114	47	18	29	88		1.39	0.72	1.50	1.63	Lean Clay
	7	10.0	12.0	UD		16									1.63	2.00	Lean Clay
	8	12.0	14.0	UD		16									1.25	1.63	Lean Clay
	9	14.0	15.0	UD		14									1.00	1.25	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-38

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-39	2	1.0	2.0	UD		17									0.88	0.88	Leon Clay
	3	2.0	4.0	UD		16									1.13	1.25	Lean Clay
	4	4.0	6.0	UD		15									1.75	2.25	Lean Clay
	5	6.0	8.0	UD		16									1.63	1.75	Lean Clay
	6	8.0	10.0	UD		16									1.25	2.00	Fat Clay
	7	10.0	12.0	UD		17	108	51	21	30	88		1.00	0.86	1.25	1.25	Fat Clay
	8	12.0	14.0	UD		16									1.50	1.63	Fat Clay
	9	14.0	15.0	UD		18									1.25	0.88	Fat Clay

LEGEND: UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-39

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-40	2	1.0	2.0	UD		28									1.00	1.38	Lean Clay
	3	2.0	4.0	UD		17									1.63	2.25	Lean Clay
	4	4.0	6.0	UD		15									1.50	2.00	Lean Clay
	5	6.0	8.0	UD		15									1.38	2.13	Lean Clay
	6	8.0	10.0	UD		17	112	42	17	25	81		1.74	0.72	1.38	1.63	Lean Clay
	7	10.0	12.0	UD		15									1.25	1.50	Lean Clay
	8	12.0	14.0	UD		20									0.75	0.63	Lean Clay
	9	14.0	15.0	UD		18									0.35	0.63	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-40

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-41	2	1.2	2.0	UD		14									1.00	1.63	Lean Clay
	3	2.0	4.0	UD		14									2.00	2.25	Lean Clay
	4	4.0	6.0	UD		14									2.25	2.25	Lean Clay
	5	6.0	8.0	UD		16									1.88	2.00	Fat Clay
	6	8.0	10.0	UD		16	113	59	23	36	87		1.14	0.72	1.63	1.38	Fat Cloy
	7	10.0	12.0	UD		20									1.00	0.88	Fat Clay
	8	12.0	14.0	UD		21									1.00	1.13	Fat Clay
	9	14.0	16.0	UD		20	109	59	23	36	85		0.65	1.15	1.00	0.50	Fat Clay
	10	16.0	18.0	UD		20									0.60	1.00	Fat Clay
	11	18.0	20.0	UD		23									0.88	1.00	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-41

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-42	2	1.0	2.0	UD		13									1.50	2.25	Lean Clay
	3	2.0	4.0	UD		12									2.25	2.25	Lean Clay
	4	4.0	6.0	UD		12	114	47	20	27	83		2.71	0.43	2.25	2.25	Lean Clay
	5	6.0	8.0	UD		15									2.00	2.25	Fat Clay
	6	8.0	10.0	UD		16									1.75	2.25	Fat Clay
	7	10.0	12.0	UD		17									1.88	2.25	Fat Clay
	8	12.0	14.0	UD		17									2.00	2.13	Fat Clay
	9	14.0	16.0	UD		19	109	55	20	35	87		1.41	1.15	1.13	1.63	Fat Clay
	10	16.0	18.0	UD		20									0.88	1.00	Fat Clay
	11	18.0	20.0	UD		19									1.25	1.50	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-42

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-43	2	1.0	2.0	UD		14									1.63	1.50	Lean Clay
	3	2.0	4.0	UD		14									0.88	2.13	Lean Clay
	4	4.0	6.0	UD		15	115	46	20	26	77		0.91	0.43	1.38	1.00	Lean Clay
	5	6.0	8.0	UD		12									1.13	1.63	Lean Clay
	6	8.0	10.0	UD		14									1.50	1.63	Lean Clay
	7	10.0	12.0	UD		19									0.55	0.50	Lean Clay
	8	12.0	14.0	UD		21									0.75	0.88	Lean Clay
	9	14.0	16.0	UD		19	109	28	13	15	65		0.31	1.15	0.40	0.50	Sandy Lean Clay
	10	16.0	18.0	UD		19									0.25	0.50	Sandy Lean Clay
	11	18.0	20.0	UD		20									1.75	1.88	Fat Clay

LEGEND: UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-43

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-44	2	1.0	2.0	AG		12											Sandy Lean Clay
	3	2.0	4.0	UD		18									2.25	2.25	Fat Clay
	4	4.0	6.0	UD		13									2.25	2.25	Fat Clay
	5	6.0	8.0	UD		13	122	52	21	31	74		2.89	0.58	2.25	2.25	Fat Clay
	6	8.0	10.0	UD		20									2.25	2.13	Fat Clay
	7	10.0	12.0	UD		30		73	29	44	89				0.40	0.50	Fat Clay
	8	12.0	14.0	UD		23									1.38	2.25	Fat Clay
	9	14.0	15.0	UD		23									1.25	2.25	Fat Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-44

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-45	2	1.0	3.0	UD		15									0.30	0.63	Lean Clay
	3	3.0	5.0	UD		17									0.75	0.75	Lean Cloy
	4	5.0	7.0	UD		18									0.75	0.75	Lean Clay
	5	7.0	9.0	UD		19	107	32	15	17	85		0.53	0.65	0.63	0.50	Lean Clay
	6	9.0	11.0	UD		18									0.63	1.13	Lean Clay
	7	11.0	13.0	UD		18									0.38	1.13	Lean Clay
	8	13.0	15.0	UD		19									0.63	0.88	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plosticity Index

FIGURE B-45

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE No.	Depth (ft.) Top	Depth (ft.) Bottom	SAMPLE Type	SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS LL	ATTERBERG LIMITS PL	ATTERBERG LIMITS PI	PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Shear Strength (tsf)	TRIAXIAL COMPRESSION TEST (U-U) Conf. Press. (tsf)	TORVANE Shear Strength (tsf)	POCKET PENE-TROMETER Shear Strength (tsf)	TYPE OF MATERIAL
GB-46	2	0.9	2.0	UD		22									0.50	0.38	Fill
	3	2.5	4.0	SS	21	14											Fill
	4	4.0	6.0	UD		25											Fill
	5	6.0	8.0	UD		20	108	54	22	32	87		0.73	0.58	1.00	0.88	Fat Clay
	6	8.0	10.0	UD		17									1.25	1.25	Fat Clay
	7	10.0	12.0	UD		20									1.00	0.88	Fat Clay
	8	12.0	14.0	UD		19									0.50	0.75	Fat Clay
	9	14.0	16.0	UD		18	110	49	19	30	89		0.88	1.15	1.50	1.50	Lean Clay
	10	16.0	18.0	UD		22									1.63	1.75	Lean Clay
	11	18.0	20.0	UD		16									1.63	2.25	Lean Clay

LEGEND: UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-46

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-47	2	1.0	2.0	UD		19									1.00	0.88	Lean Clay
	3	2.0	4.0	UD		19									1.25	1.13	Lean Clay
	4	4.0	6.0	UD		19									1.13	1.13	Lean Clay
	5	6.0	8.0	UD		19									1.00	0.88	Lean Clay
	6	8.0	10.0	UD		20									1.25	1.13	Lean Clay
	7	10.0	12.0	UD		21	107	49	21	28	90		0.78	0.86	1.00	1.00	Lean Clay
	8	12.0	13.0	UD		20									1.00	0.88	Lean Clay
	9	13.0	15.0	UD		22									0.88	1.00	Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-47

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-48	2	1.0	2.0	UD		18									1.00	1.13	Fill
	3	2.5	4.0	SS	17	10											Fill
	4	4.5	6.0	SS	22	13					19						Fill
	5	6.0	8.0	UD		25									0.70	0.75	Fill
	6	8.0	10.0	UD		20	110	58	23	35	90		0.83	0.72	1.00	1.00	Fat Clay
	7	10.0	12.0	UD		23									1.00	1.25	Fat Clay
	8	12.0	14.0	UD		21									1.50	1.50	Fat Clay
	9	14.0	16.0	UD		20	108						0.83	1.15	1.63	1.50	Fat Clay
	10	16.0	18.0	UD		20									1.25	1.25	Fat Clay
	11	18.0	20.0	UD		18		37	16	21	68				0.75	1.13	Sandy Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-48

SUMMARY OF LABORATORY TEST RESULTS

GEOTEST ENGINEERING, INC.

PROJECT NAME: COH Water Line Replacement in Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas
PROJECT NUMBER: 1140194601

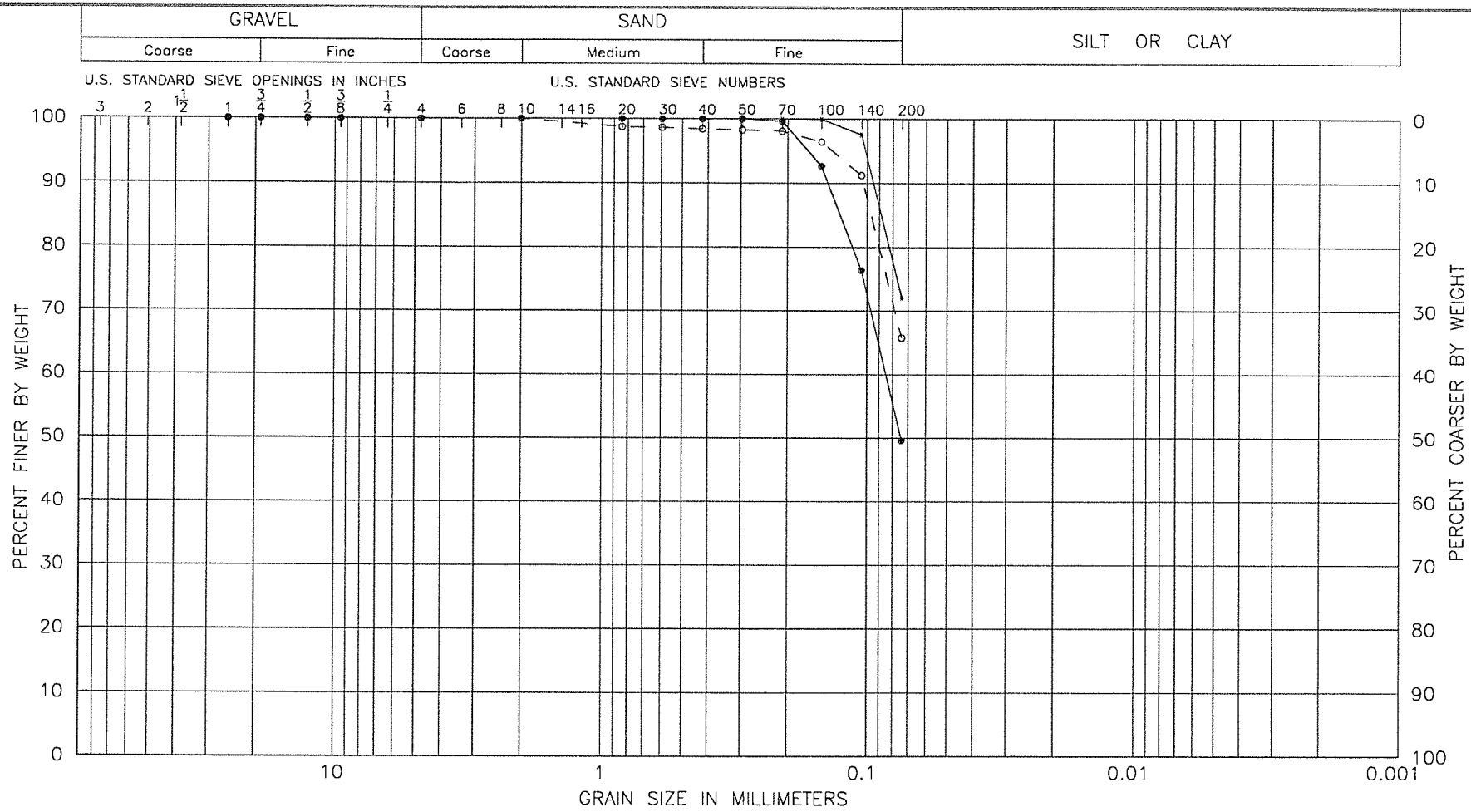
BORING NO.	SAMPLE				SPT (blows/ft.)	WATER CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS			PASSING NO. 200 SIEVE (%)	UNCONFINED COMPRESSION TEST	TRIAXIAL COMPRESSION TEST (U-U)		TORVANE	POCKET PENE-TROMETER	TYPE OF MATERIAL
	No.	Depth (ft.) Top	Depth (ft.) Bottom	Type				LL	PL	PI		Shear Strength (tsf)	Shear Strength (tsf)	Conf. Press. (tsf)	Shear Strength (tsf)	Shear Strength (tsf)	
GB-50	2	1.0	2.0	UD		27									0.50	0.63	Sandy Lean Clay
	3	2.0	4.0	UD		18									0.75	1.00	Sandy Lean Clay
	4	4.0	6.0	UD		16									1.13	1.25	Sandy Lean Clay
	5	6.0	8.0	UD		15									1.25	1.38	Sandy Lean Clay
	6	8.0	10.0	UD		15									1.00	1.50	Sandy Lean Clay
	7	10.0	12.0	UD		16	118	40	16	24	70		1.07	0.86	0.88	1.25	Sandy Lean Clay
	8	12.0	14.0	UD		15									1.25	1.50	Sandy Lean Clay
	9	14.0	15.0	UD		16									1.25	1.25	Sandy Lean Clay

LEGEND:
UD = UNDISTURBED SAMPLE, EXTRUDED IN FIELD
SS = SPLIT SPOON SAMPLE
AG = AUGER CUTTINGS
PB = PITCHER BARREL SAMPLE
Nx = Nx-DOUBBLE BARREL SAMPLE

SPT = Standard Penetration Test
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index

FIGURE B-50

Job No. 1140194601



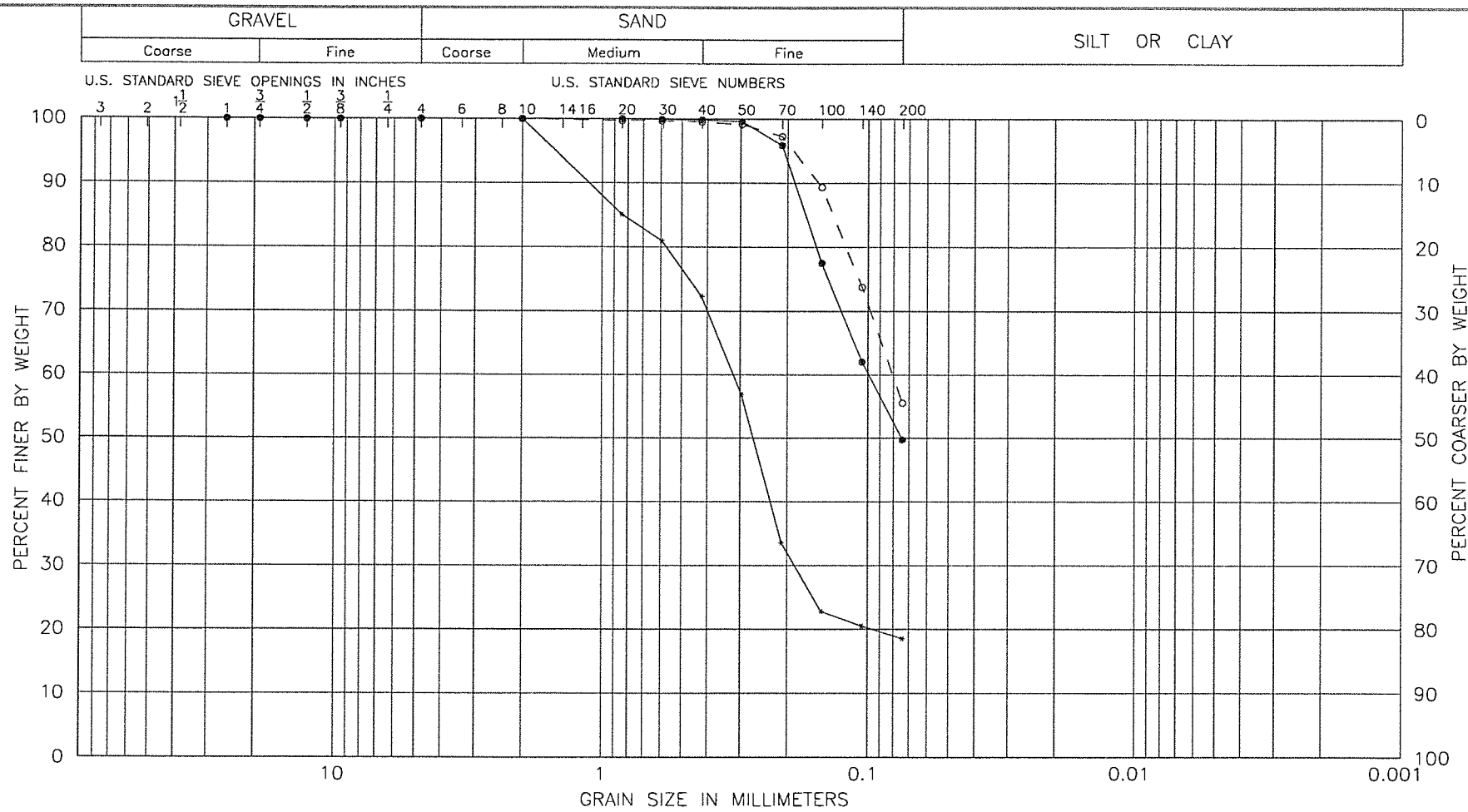
LEGEND	BORING NO.	SAMPLE NO.	DEPTH FT.	SAMPLE DESCRIPTION
●-●-●-●	GB-9	S-7	12.0-14.0	Gray silty sand
○-○-○-○	GB-11	S-7	12.0-14.0	Gray and reddish brown sandy silt w/clay seams
×-×-×-×	GB-18	S-8	14.5-16.0	Reddish brown silt w/sand

GRAIN SIZE DISTRIBUTION CURVES

Geotest Engineering, Inc.

FIGURE B-51

Job No. 1140194601



LEGEND	BORING NO.	SAMPLE NO.	DEPTH FT.	SAMPLE DESCRIPTION
●●●●●	GB-32	S-6	10.5-12.0	Gray sandy silt w/lean clay seams
○○○○○	GB-35	S-7	12.0-13.5	Gray sandy silt
××××××	GB-48	S-3	4.0-6.0	Gray fat clay w/sand

GRAIN SIZE DISTRIBUTION CURVES

Geotest Engineering, Inc.

FIGURE B-52

APPENDIX C

Piezometer Abandonment Reports

STATE OF TEXAS PLUGGING REPORT for Tracking #89213

Owner:	**Geotest Engineering, Inc**	Owner Well #:	**GB -1P**
Address:	**5600 Bintliff Rd. Houston , TX 77036**	Grid #:	**65-12-7**
Well Location:	**Chadbourne Dr. Houston , TX 77056**	Latitude:	**29° 46' 08" N**
Well County:	**Harris**	Longitude:	**095° 36' 06" W**
		GPS Brand Used:	**Lowrance XOG**

Well Type: **Monitor**

HISTORICAL DATA ON WELL TO BE PLUGGED

Original Well Driller:	**Dempsey Gearen Jr.**
Driller's License Number of Original Well Driller:	**2836**
Date Well Drilled:	**5/6/2013**
Well Report Tracking Number:	**324091**
Diameter of Borehole:	**5" inches**
Total Depth of Borehole:	**15' feet**

Date Well Plugged:	**8/12/2013**
Person Actually Performing Plugging Operation:	**Dempsey Gearen Jr.**
License Number of Plugging Operator:	**2836**
Plugging Method:	**Tremmie pipe cement from bottom to top.**
Plugging Variance #:	**No Data**
Casing Left Data:	1st Interval: **0 inches diameter, (No Data) ft to (No Data) ft** 2nd Interval: **No Data** 3rd Interval: **No Data**
Cement/Bentonite Plugs Placed in	1st Interval: **From 0 ft to 15 ft; Sack(s)/type of cement used: 1 Portland** 2nd Interval: **No Data**

Well:	3rd Interval: **No Data** 4th Interval: **No Data** 5th Interval: **No Data**

Certification Data:	The plug installer certified that the plug installer plugged this well (or the well was plugged under the plug installer's direct supervision) and that each and all of the statements herein are true and correct. The plug installer understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.
Company Information:	**Dempsey Gearen Jr.** **32126 Rochen Rd.** **Waller , TX 77484**
Plug Installer License Number:	**2836**
Licensed Plug Installer Signature:	**Dempsey Gearen Jr.**
Registered Plug Installer Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Plugging Method Comments:	**No Data**

Please include the plugging report's tracking number (Tracking **#89213**) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

STATE OF TEXAS PLUGGING REPORT for Tracking #89216

Owner:	**Geotest Engineering, Inc**	Owner Well #:	**GB - 22P**
Address:	**5600 Bintliff Dr. Houston , TX 77036**	Grid #:	**65-12-7**
Well Location:	**Kellywood Lane Houston , TX 77056**	Latitude:	**29° 45' 54" N**
Well County:	**Harris**	Longitude:	**095° 35' 51" W**
		GPS Brand Used:	**Lowrance XOG**

Well Type: **Monitor**

HISTORICAL DATA ON WELL TO BE PLUGGED

Original Well Driller:	**Dempsey Gearen Jr.**
Driller's License Number of Original Well Driller:	**2836**
Date Well Drilled:	**5/6/2013**
Well Report Tracking Number:	**324094**
Diameter of Borehole:	**5" inches**
Total Depth of Borehole:	**18' feet**

Date Well Plugged:	**8/12/2013**
Person Actually Performing Plugging Operation:	**Dempsey Gearen Jr.**
License Number of Plugging Operator:	**2836**
Plugging Method:	**Tremmie pipe cement from bottom to top.**
Plugging Variance #:	**No Data**
Casing Left Data:	1st Interval: **0 inches diameter, (No Data) ft to (No Data) ft** 2nd Interval: **No Data** 3rd Interval: **No Data**
Cement/Bentonite Plugs Placed in	1st Interval: **From 0 ft to 18 ft; Sack(s)/type of cement used: 1 1/2 Portland** 2nd Interval: **No Data**

Well:	3rd Interval: **No Data** 4th Interval: **No Data** 5th Interval: **No Data**

Certification Data:	The plug installer certified that the plug installer plugged this well (or the well was plugged under the plug installer's direct supervision) and that each and all of the statements herein are true and correct. The plug installer understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.
Company Information:	**Gearen Drilling** **32126 Rochen Rd.** **Waller , TX 77484**
Plug Installer License Number:	**2836**
Licensed Plug Installer Signature:	**Dempsey Gearen Jr.**
Registered Plug Installer Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Plugging Method Comments:	**No Data**

Please include the plugging report's tracking number (Tracking #**89216**) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

STATE OF TEXAS PLUGGING REPORT for Tracking #89214

Owner:	**Geotest Engineering, Inc**	Owner Well #:	**GB -36P**
Address:	**5600 Bintliff Rd. Houston , TX 77036**	Grid #:	**65-12-7**
Well Location:	**Heatherfield Dr. Houston , TX 77056**	Latitude:	**29° 45' 39" N**
Well County:	**Harris**	Longitude:	**095° 35' 28" W**
		GPS Brand Used:	**Lowrance XOG**

Well Type: **Monitor**

HISTORICAL DATA ON WELL TO BE PLUGGED

Original Well Driller:	**Dempsey Gearen Jr.**
Driller's License Number of Original Well Driller:	**2836**
Date Well Drilled:	**5/6/2013**
Well Report Tracking Number:	**324097**
Diameter of Borehole:	**5" inches**
Total Depth of Borehole:	**14' feet**

Date Well Plugged:	**8/12/2013**
Person Actually Performing Plugging Operation:	**Dempsey Gearen Jr.**
License Number of Plugging Operator:	**2836**
Plugging Method:	**Tremmie pipe cement from bottom to top.**
Plugging Variance #:	**No Data**
Casing Left Data:	1st Interval: **0 inches diameter, (No Data) ft to (No Data) ft** 2nd Interval: **No Data** 3rd Interval: **No Data**
Cement/Bentonite Plugs Placed in	1st Interval: **From 0 ft to 14 ft; Sack(s)/type of cement used: 1 Portland** 2nd Interval: **No Data**

Well:	3rd Interval: **No Data** 4th Interval: **No Data** 5th Interval: **No Data**

Certification Data:	The plug installer certified that the plug installer plugged this well (or the well was plugged under the plug installer's direct supervision) and that each and all of the statements herein are true and correct. The plug installer understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.
Company Information:	**Dempsey Gearen Jr.** **32126 Rochen Rd.** **Waller , TX 77484**
Plug Installer License Number:	**2836**
Licensed Plug Installer Signature:	**Dempsey Gearen Jr.**
Registered Plug Installer Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Plugging Method Comments:	**No Data**

Please include the plugging report's tracking number (Tracking #**89214**) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

STATE OF TEXAS PLUGGING REPORT for Tracking #89215

Owner:	**Geotest Engineering, Inc**	Owner Well #:	**GB -49P**
Address:	**5600 Bintliff Rd. Houston , TX 77036**	Grid #:	**65-12-7**
Well Location:	**White Wing Houston , TX 77056**	Latitude:	**29° 46' 12" N**
Well County:	**Harris**	Longitude:	**095° 35' 29" W**
		GPS Brand Used:	**Lowrance XOG**

Well Type: **Monitor**

HISTORICAL DATA ON WELL TO BE PLUGGED

Original Well Driller:	**Dempsey Gearen Jr.**
Driller's License Number of Original Well Driller:	**2836**
Date Well Drilled:	**5/6/2013**
Well Report Tracking Number:	**324100**
Diameter of Borehole:	**5" inches**
Total Depth of Borehole:	**20' feet**

Date Well Plugged:	**8/12/2013**
Person Actually Performing Plugging Operation:	**Dempsey Gearen Jr.**
License Number of Plugging Operator:	**2836**
Plugging Method:	**Tremmie pipe cement from bottom to top.**
Plugging Variance #:	**No Data**
Casing Left Data:	1st Interval: **0 inches diameter, (No Data) ft to (No Data) ft** 2nd Interval: **No Data** 3rd Interval: **No Data**
Cement/Bentonite Plugs Placed in	1st Interval: **From 0 ft to 20 ft; Sack(s)/type of cement used: 1 1/2 Portland** 2nd Interval: **No Data**

Well:	3rd Interval: **No Data** 4th Interval: **No Data** 5th Interval: **No Data**

Certification Data:	The plug installer certified that the plug installer plugged this well (or the well was plugged under the plug installer's direct supervision) and that each and all of the statements herein are true and correct. The plug installer understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.
Company Information:	**Dempsey Gearen Jr.** **32126 Rochen Rd.** **Waller , TX 77484**
Plug Installer License Number:	**2836**
Licensed Plug Installer Signature:	**Dempsey Gearen Jr.**
Registered Plug Installer Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Plugging Method Comments:	**No Data**

Please include the plugging report's tracking number (Tracking #**89215**) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

APPENDIX D

Laboratory Corrosivity Test Report

Analytical Report 465370

for

Geotest Engineering, Inc.

Project Manager: Mohan Ballagere

Waterline Replacement Kickerillo Area

1140194601

21-JUN-13

Collected By: Client

4143 Greenbriar Dr., Stafford, TX 77477

Xenco-Houston (EPA Lab code: TX00122):
Texas (T104704215-10-6-TX), Arizona (AZ0765), Arkansas (08-039-0), Connecticut (PH-0102), Florida (E871002)
Illinois (002082), Indiana (C-TX-02), Iowa (392), Kansas (E-10380), Kentucky (45), Louisiana (03054)
New Hampshire (297408), New Jersey (TX007), New York (11763), Oklahoma (9218), Pennsylvania (68-03610)
Rhode Island (LAO00312), USDA (S-44102), DoD (L11-54)

Xenco-Atlanta (EPA Lab Code: GA00046):
Florida (E87429), North Carolina (483), South Carolina (98015), Kentucky (85), DoD (L10-135)
Louisiana (04176), USDA (P330-07-00105)

Xenco-Tampa Mobile (EPA Lab code: FL01212): Florida (E84900)
Xenco-Lakeland: Florida (E84098)
Xenco-Odessa (EPA Lab code: TX00158): Texas (T104704400-TX)
Xenco-Dallas (EPA Lab code: TX01468): Texas (T104704295-TX)
Xenco Phoenix (EPA Lab Code: AZ00901): Arizona(AZ0757)
Xenco-Phoenix Mobile (EPA Lab code: AZ00901): Arizona (AZM757)
Xenco Tucson (EPA Lab code:AZ000989): Arizona (AZ0758)

21-JUN-13

Project Manager: **Mohan Ballagere**
Geotest Engineering, Inc.
5600 Bintliff
Houston, TX 77036

Reference: XENCO Report No(s): **465370**
Waterline Replacement Kickerillo Area
Project Address:

Mohan Ballagere:

We are reporting to you the results of the analyses performed on the samples received under the project name referenced above and identified with the XENCO Report Number(s) 465370. All results being reported under this Report Number apply to the samples analyzed and properly identified with a Laboratory ID number. Subcontracted analyses are identified in this report with either the NELAC certification number of the subcontract lab in the analyst ID field, or the complete subcontracted report attached to this report.

Unless otherwise noted in a Case Narrative, all data reported in this Analytical Report are in compliance with NELAC standards. The uncertainty of measurement associated with the results of analysis reported is available upon request. Should insufficient sample be provided to the laboratory to meet the method and NELAC Matrix Duplicate and Matrix Spike requirements, then the data will be analyzed, evaluated and reported using all other available quality control measures.

The validity and integrity of this report will remain intact as long as it is accompanied by this letter and reproduced in full, unless written approval is granted by XENCO Laboratories. This report will be filed for at least 5 years in our archives after which time it will be destroyed without further notice, unless otherwise arranged with you. The samples received, and described as recorded in Report No. 465370 will be filed for 60 days, and after that time they will be properly disposed without further notice, unless otherwise arranged with you. We reserve the right to return to you any unused samples, extracts or solutions related to them if we consider so necessary (e.g., samples identified as hazardous waste, sample sizes exceeding analytical standard practices, controlled substances under regulated protocols, etc).

We thank you for selecting XENCO Laboratories to serve your analytical needs. If you have any questions concerning this report, please feel free to contact us at any time.

Respectfully,

Debbie Simmons

Debbie Simmons
Project Manager

Sample Cross Reference 465370

Geotest Engineering, Inc., Houston, TX

Waterline Replacement Kickerillo Area

Sample Id	Matrix	Date Collected	Sample Depth	Lab Sample Id
GB-2 S#5	S	05-06-13 00:00	8 - 10 ft	465370-001
GB-5 S#5	S	05-06-13 00:00	8 - 10 ft	465370-002
GB-6 S#4	S	05-06-13 00:00	6 - 8 ft	465370-003
GB-7 S#4	S	05-06-13 00:00	6 - 8 ft	465370-004
GB-9 S#4	S	05-07-13 00:00	6 - 8 ft	465370-005
GB-13 S#6B	S	05-07-13 00:00	10 - 12 ft	465370-006
GB-16 S#5	S	05-08-13 00:00	8 - 10 ft	465370-007
GB-17 S#7	S	05-08-13 00:00	12 - 14 ft	465370-008
GB-22 S#7	S	05-06-13 00:00	12 - 14 ft	465370-009
GB-24 S#6	S	05-06-13 00:00	10 - 12 ft	465370-010
GB-34 S#4	S	05-06-13 00:00	6 - 8 ft	465370-011
GB-38 S#6	S	05-08-13 00:00	10 - 12 ft	465370-012
GB-41 S#6	S	05-08-13 00:00	10 - 12 ft	465370-013
GB-42 S#6	S	05-08-13 00:00	10 - 12 ft	465370-014
GB-43 S#7	S	05-08-13 00:00	10 - 12 ft	465370-015
GB-46 S#5	S	05-07-13 00:00	8 - 10 ft	465370-016
GB-48 S#7	S	05-07-13 00:00	12 - 14 ft	465370-017
GB-50 S#4	S	05-07-13 00:00	6 - 8 ft	465370-018

CASE NARRATIVE

Client Name: Geotest Engineering, Inc.

Project Name: Waterline Replacement Kickerillo Area

Project ID: *1140194601*
Work Order Number(s): *465370*

Report Date: *21-JUN-13*
Date Received: *06/20/2013*

Sample receipt non conformances and comments:

Sample receipt non conformances and comments per sample:

None

Certificate of Analysis Summary 465370

Geotest Engineering, Inc., Houston, TX

Project Name: Waterline Replacement Kickerillo Area

Project Id: 1140194601
Contact: Mohan Ballagere
Project Location:

Date Received in Lab: Thu Jun-20-13 10:40 am
Report Date: 21-JUN-13
Project Manager: Debbie Simmons

Analysis Requested													
	Lab Id:	465370-001		465370-002		465370-003		465370-004		465370-005		465370-006	
	Field Id:	GB-2 S#5		GB-5 S#5		GB-6 S#4		GB-7 S#4		GB-9 S#4		GB-13 S#6B	
	Depth:	8-10 ft		8-10 ft		6-8 ft		6-8 ft		6-8 ft		10-12 ft	
	Matrix:	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
	Sampled:	May-06-13 00:00		May-06-13 00:00		May-06-13 00:00		May-06-13 00:00		May-07-13 00:00		May-07-13 00:00	
Inorganic Anions by SW 9056	***Extracted:***	Jun-20-13 16:26		Jun-20-13 16:26		Jun-20-13 16:26		Jun-20-13 16:26		Jun-20-13 16:26		Jun-20-13 16:26	
	Analyzed:	Jun-21-13 02:45		Jun-21-13 03:40		Jun-21-13 03:58		Jun-21-13 04:17		Jun-21-13 04:35		Jun-21-13 04:53	
	Units/RL:	mg/kg	RL	mg/kg	RL	mg/kg	RL	mg/kg	RL	mg/kg	RL	mg/kg	RL
Chloride		55.3 K	10.0	179 K	9.62	65.8 K	10.0	242 K	10.0	46.0 K	10.0	135 K	9.71
Sulfate		BRL	10.0	BRL	9.62	12.9 K	10.0	BRL	10.0	BRL	10.0	31.5 K	9.71
Soil Resistivity (As Received) by NACE	***Extracted:***												
	Analyzed:	Jun-21-13 09:42		Jun-21-13 09:50		Jun-21-13 09:55		Jun-21-13 10:07		Jun-21-13 10:14		Jun-21-13 10:19	
	Units/RL:	Ohm-cm	RL	Ohm-cm	RL	Ohm-cm	RL	Ohm-cm	RL	Ohm-cm	RL	Ohm-cm	RL
Soil Resistivity		1480 K		1300 K		3050 K		1690 K		2280 K		1640 K	
Soil pH by EPA 9045C	***Extracted:***												
	Analyzed:	Jun-20-13 14:52		Jun-20-13 14:52		Jun-20-13 14:52		Jun-20-13 14:52		Jun-20-13 14:52		Jun-20-13 14:52	
	Units/RL:	SU	RL	SU	RL	SU	RL	SU	RL	SU	RL	SU	RL
pH		7.43 K		8.83 K		9.35 K		8.17 K		8.39 K		8.67 K	

Debbie Simmons
Project Manager

Certificate of Analysis Summary 465370

Geotest Engineering, Inc., Houston, TX

Project Name: Waterline Replacement Kickerillo Area

Project Id: 1140194601
Contact: Mohan Ballagere
Project Location:

Date Received in Lab: Thu Jun-20-13 10:40 am
Report Date: 21-JUN-13
Project Manager: Debbie Simmons

Analysis Requested													
	Lab Id:	465370-007		465370-008		465370-009		465370-010		465370-011		465370-012	
	Field Id:	GB-16 S#5		GB-17 S#7		GB-22 S#7		GB-24 S#6		GB-34 S#4		GB-38 S#6	
	Depth:	8-10 ft		12-14 ft		12-14 ft		10-12 ft		6-8 ft		10-12 ft	
	Matrix:	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
	Sampled:	May-08-13 00:00		May-08-13 00:00		May-06-13 00:00		May-06-13 00:00		May-06-13 00:00		May-08-13 00:00	
Inorganic Anions by SW 9056	***Extracted:***	Jun-20-13 16:26		Jun-20-13 16:26		Jun-20-13 16:26		Jun-20-13 16:26		Jun-20-13 16:26		Jun-20-13 16:26	
	Analyzed:	Jun-21-13 05:49		Jun-21-13 06:07		Jun-21-13 06:26		Jun-21-13 06:44		Jun-21-13 07:02		Jun-21-13 07:58	
	Units/RL:	mg/kg	RL	mg/kg	RL	mg/kg	RL	mg/kg	RL	mg/kg	RL	mg/kg	RL
Chloride		20.7 K	9.52	66.0 K	10.0	43.2 K	9.90	17.4 K	10.0	41.8 K	10.0	20.9 K	10.0
Sulfate		BRL	9.52	19.7 K	10.0	24.5 K	9.90	BRL	10.0	13.6 K	10.0	BRL	10.0
Soil Resistivity (As Received) by NACE	***Extracted:***												
	Analyzed:	Jun-21-13 10:36		Jun-21-13 10:43		Jun-21-13 10:49		Jun-21-13 11:07		Jun-21-13 11:16		Jun-21-13 11:22	
	Units/RL:	Ohm-cm	RL	Ohm-cm	RL	Ohm-cm	RL	Ohm-cm	RL	Ohm-cm	RL	Ohm-cm	RL
Soil Resistivity		1340 K		1730 K		2400 K		1000 K		2230 K		1870 K	
Soil pH by EPA 9045C	***Extracted:***												
	Analyzed:	Jun-20-13 14:52		Jun-20-13 14:52		Jun-20-13 14:52		Jun-20-13 14:52		Jun-20-13 14:52		Jun-20-13 14:52	
	Units/RL:	SU	RL	SU	RL	SU	RL	SU	RL	SU	RL	SU	RL
pH		9.31 K		9.91 K		9.29 K		9.15 K		8.35 K		8.79 K	

Debbie Simmons
Project Manager

Certificate of Analysis Summary 465370

Geotest Engineering, Inc., Houston, TX

Project Name: Waterline Replacement Kickerillo Area

Project Id: 1140194601
Contact: Mohan Ballagere
Project Location:

Date Received in Lab: Thu Jun-20-13 10:40 am
Report Date: 21-JUN-13
Project Manager: Debbie Simmons

Analysis Requested													
	Lab Id:	465370-013		465370-014		465370-015		465370-016		465370-017		465370-018	
	Field Id:	GB-41 S#6		GB-42 S#6		GB-43 S#7		GB-46 S#5		GB-48 S#7		GB-50 S#4	
	Depth:	10-12 ft		10-12 ft		10-12 ft		8-10 ft		12-14 ft		6-8 ft	
	Matrix:	SOIL		SOIL		SOIL		SOIL		SOIL		SOIL	
	Sampled:	May-08-13 00:00		May-08-13 00:00		May-08-13 00:00		May-07-13 00:00		May-07-13 00:00		May-07-13 00:00	
Inorganic Anions by SW 9056	***Extracted:***	Jun-20-13 16:26		Jun-20-13 16:26		Jun-20-13 16:26		Jun-20-13 16:26		Jun-20-13 16:26		Jun-20-13 16:26	
	Analyzed:	Jun-21-13 08:16		Jun-21-13 08:34		Jun-21-13 09:30		Jun-21-13 09:48		Jun-21-13 10:06		Jun-21-13 10:25	
	Units/RL:	mg/kg	RL	mg/kg	RL	mg/kg	RL	mg/kg	RL	mg/kg	RL	mg/kg	RL
Chloride		19.5 K	10.0	34.9 K	10.0	38.7 K	10.0	19.1 K	10.0	29.2 K	9.71	19.5 K	9.80
Sulfate		132 K	10.0	14.0 K	10.0	10.7 K	10.0	10.6 K	10.0	10.7 K	9.71	BRL	9.80
Soil Resistivity (As Received) by NACE	***Extracted:***												
	Analyzed:	Jun-21-13 11:28		Jun-21-13 12:29		Jun-21-13 12:35		Jun-21-13 12:41		Jun-21-13 12:47		Jun-21-13 12:56	
	Units/RL:	Ohm-cm	RL	Ohm-cm	RL	Ohm-cm	RL	Ohm-cm	RL	Ohm-cm	RL	Ohm-cm	RL
Soil Resistivity		996 K		1700 K		1140 K		944 K		941 K		1630 K	
Soil pH by EPA 9045C	***Extracted:***												
	Analyzed:	Jun-20-13 14:52		Jun-20-13 14:52		Jun-20-13 14:52		Jun-20-13 14:52		Jun-20-13 14:52		Jun-20-13 14:52	
	Units/RL:	SU	RL	SU	RL	SU	RL	SU	RL	SU	RL	SU	RL
pH		8.02 K		9.00 K		9.67 K		8.69 K		7.94 K		8.40 K	

Debbie Simmons
Project Manager

XENCO Laboratories
CHRONOLOGY OF HOLDING TIMES

Analytical Method : Soil pH by EPA 9045C

Client : Geotest Engineering, Inc.

Work Order #: **465370**

Project ID: 1140194601

Field Sample ID	Date Collected	Date Received	Date Extracted	Max Holding Time Extracted (Days)	Time Held Extracted (Days	Date Analyzed	Max Holding Time Analyzed (Days)	Time Held Analyzed **(Days)**	Q
GB-17 S#7	May. 8, 2013	Jun. 20, 2013				Jun.20, 2013	28	43	F
GB-41 S#6	May. 8, 2013	Jun. 20, 2013				Jun.20, 2013	28	43	F
GB-6 S#4	May. 6, 2013	Jun. 20, 2013				Jun.20, 2013	28	45	F
GB-7 S#4	May. 6, 2013	Jun. 20, 2013				Jun.20, 2013	28	45	F
GB-16 S#5	May. 8, 2013	Jun. 20, 2013				Jun.20, 2013	28	43	F
GB-24 S#6	May. 6, 2013	Jun. 20, 2013				Jun.20, 2013	28	45	F
GB-34 S#4	May. 6, 2013	Jun. 20, 2013				Jun.20, 2013	28	45	F
GB-43 S#7	May. 8, 2013	Jun. 20, 2013				Jun.20, 2013	28	43	F
GB-50 S#4	May. 7, 2013	Jun. 20, 2013				Jun.20, 2013	28	44	F
GB-38 S#6	May. 8, 2013	Jun. 20, 2013				Jun.20, 2013	28	43	F
GB-5 S#5	May. 6, 2013	Jun. 20, 2013				Jun.20, 2013	28	45	F
GB-9 S#4	May. 7, 2013	Jun. 20, 2013				Jun.20, 2013	28	44	F
GB-22 S#7	May. 6, 2013	Jun. 20, 2013				Jun.20, 2013	28	45	F
GB-48 S#7	May. 7, 2013	Jun. 20, 2013				Jun.20, 2013	28	44	F
GB-13 S#6B	May. 7, 2013	Jun. 20, 2013				Jun.20, 2013	28	44	F
GB-42 S#6	May. 8, 2013	Jun. 20, 2013				Jun.20, 2013	28	43	F
GB-46 S#5	May. 7, 2013	Jun. 20, 2013				Jun.20, 2013	28	44	F
GB-2 S#5	May. 6, 2013	Jun. 20, 2013				Jun.20, 2013	28	45	F

XENCO Laboratories
CHRONOLOGY OF HOLDING TIMES

Analytical Method : Inorganic Anions by SW 9056 Client : Geotest Engineering, Inc.

Work Order #: **465370** Project ID: 1140194601

Field Sample ID	Date Collected	Date Received	Date Extracted	Max Holding Time Extracted (Days)	Time Held Extracted (Days	Date Analyzed	Max Holding Time Analyzed (Days)	Time Held Analyzed **(Days)**	Q
GB-17 S#7	May. 8, 2013	Jun. 20, 2013	Jun. 20, 2013	28	43	Jun.21, 2013	28	1	F
GB-24 S#6	May. 6, 2013	Jun. 20, 2013	Jun. 20, 2013	28	45	Jun.21, 2013	28	1	F
GB-6 S#4	May. 6, 2013	Jun. 20, 2013	Jun. 20, 2013	28	45	Jun.21, 2013	28	1	F
GB-34 S#4	May. 6, 2013	Jun. 20, 2013	Jun. 20, 2013	28	45	Jun.21, 2013	28	1	F
GB-42 S#6	May. 8, 2013	Jun. 20, 2013	Jun. 20, 2013	28	43	Jun.21, 2013	28	1	F
GB-9 S#4	May. 7, 2013	Jun. 20, 2013	Jun. 20, 2013	28	44	Jun.21, 2013	28	1	F
GB-13 S#6B	May. 7, 2013	Jun. 20, 2013	Jun. 20, 2013	28	44	Jun.21, 2013	28	1	F
GB-41 S#6	May. 8, 2013	Jun. 20, 2013	Jun. 20, 2013	28	43	Jun.21, 2013	28	1	F
GB-2 S#5	May. 6, 2013	Jun. 20, 2013	Jun. 20, 2013	28	45	Jun.21, 2013	28	1	F
GB-46 S#5	May. 7, 2013	Jun. 20, 2013	Jun. 20, 2013	28	44	Jun.21, 2013	28	1	F
GB-7 S#4	May. 6, 2013	Jun. 20, 2013	Jun. 20, 2013	28	45	Jun.21, 2013	28	1	F
GB-16 S#5	May. 8, 2013	Jun. 20, 2013	Jun. 20, 2013	28	43	Jun.21, 2013	28	1	F
GB-38 S#6	May. 8, 2013	Jun. 20, 2013	Jun. 20, 2013	28	43	Jun.21, 2013	28	1	F
GB-5 S#5	May. 6, 2013	Jun. 20, 2013	Jun. 20, 2013	28	45	Jun.21, 2013	28	1	F
GB-22 S#7	May. 6, 2013	Jun. 20, 2013	Jun. 20, 2013	28	45	Jun.21, 2013	28	1	F
GB-43 S#7	May. 8, 2013	Jun. 20, 2013	Jun. 20, 2013	28	43	Jun.21, 2013	28	1	F
GB-48 S#7	May. 7, 2013	Jun. 20, 2013	Jun. 20, 2013	28	44	Jun.21, 2013	28	1	F
GB-50 S#4	May. 7, 2013	Jun. 20, 2013	Jun. 20, 2013	28	44	Jun.21, 2013	28	1	F

F = These samples were analyzed outside the recommended holding time.
P = Samples analyzed within the recommended holding time.

Flagging Criteria

X In our quality control review of the data a QC deficiency was observed and flagged as noted. MS/MSD recoveries were found to be outside of the laboratory control limits due to possible matrix /chemical interference, or a concentration of target analyte high enough to affect the recovery of the spike concentration. This condition could also affect the relative percent difference in the MS/MSD.

B A target analyte or common laboratory contaminant was identified in the method blank. Its presence indicates possible field or laboratory contamination.

D The sample(s) were diluted due to targets detected over the highest point of the calibration curve, or due to matrix interference. Dilution factors are included in the final results. The result is from a diluted sample.

E The data exceeds the upper calibration limit; therefore, the concentration is reported as estimated.

F RPD exceeded lab control limits.

J The target analyte was positively identified below the quantiation limit and above the detection limit.

U Analyte was not detected.

L The LCS data for this analytical batch was reported below the laboratory control limits for this analyte. The department supervisor and QA Director reviewed data. The samples were either reanalyzed or flagged as estimated concentrations.

H The LCS data for this analytical batch was reported above the laboratory control limits. Supporting QC Data were reviewed by the Department Supervisor and QA Director. Data were determined to be valid for reporting.

K Sample analyzed outside of recommended hold time.

JN A combination of the "N" and the "J" qualifier. The analysis indicates that the analyte is "tentatively identified" and the associated numerical value may not be consistent with the amount actually present in the environmental sample.

* Surrogate recovered outside laboratory control limit.

BRL Below Reporting Limit.

RL Reporting Limit

MDL Method Detection Limit **SDL** Sample Detection Limit **LOD** Limit of Detection

PQL Practical Quantitation Limit **MQL** Method Quantitation Limit **LOQ** Limit of Quantitation

DL Method Detection Limit

NC Non-Calculable

\+ NELAC certification not offered for this compound.

***** (Next to analyte name or method description) = Outside XENCO's scope of NELAC accreditation

Blank Spike Recovery

Project Name: Waterline Replacement Kickerillo Area

Work Order #: 465370 **Project ID:** 1140194601

Lab Batch #: 916770 **Sample:** 640005-1-BKS **Matrix:** Solid

Date Analyzed: 06/21/2013 **Date Prepared:** 06/20/2013 **Analyst:** RKO

Reporting Units: mg/kg **Batch #:** 1 **BLANK /BLANK SPIKE RECOVERY STUDY**

Inorganic Anions by SW 9056 Analytes	Blank Result [A]	Spike Added [B]	Blank Spike Result [C]	Blank Spike %R [D]	Control Limits %R	Flags
Chloride	<10.0	500	486	97	80-120	
Sulfate	<10.0	500	453	91	80-120	

Blank Spike Recovery [D] = 100*[C]/[B]
All results are based on MDL and validated for QC purposes.

BRL - Below Reporting Limit

Form 3 - MS / MSD Recoveries

Project Name: Waterline Replacement Kickerillo Area

Work Order # : 465370 **Project ID:** 1140194601

Lab Batch ID: 916770 **QC- Sample ID:** 465370-001 S **Batch #:** 1 **Matrix:** Soil

Date Analyzed: 06/21/2013 **Date Prepared:** 06/20/2013 **Analyst:** RKO

Reporting Units: mg/kg

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY STUDY

Inorganic Anions by SW 9056 Analytes	Parent Sample Result [A]	Spike Added [B]	Spiked Sample Result [C]	Spiked Sample %R [D]	Spike Added [E]	Duplicate Spiked Sample Result [F]	Spiked Dup. %R [G]	RPD %	Control Limits %R	Control Limits %RPD	Flag
Chloride	55.3	500	522	93	500	521	93	0	80-120	20	
Sulfate	<10.0	500	444	89	500	442	88	0	80-120	20	

Lab Batch ID: 916770 **QC- Sample ID:** 465370-011 S **Batch #:** 1 **Matrix:** Soil

Date Analyzed: 06/21/2013 **Date Prepared:** 06/20/2013 **Analyst:** RKO

Reporting Units: mg/kg

MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY STUDY

Inorganic Anions by SW 9056 Analytes	Parent Sample Result [A]	Spike Added [B]	Spiked Sample Result [C]	Spiked Sample %R [D]	Spike Added [E]	Duplicate Spiked Sample Result [F]	Spiked Dup. %R [G]	RPD %	Control Limits %R	Control Limits %RPD	Flag
Chloride	41.8	500	501	92	500	504	92	1	80-120	20	
Sulfate	13.6	500	444	86	500	445	86	0	80-120	20	

Matrix Spike Percent Recovery [D] = 100*(C-A)/B
Relative Percent Difference RPD = 200*|(C-F)/(C+F)|

Matrix Spike Duplicate Percent Recovery [G] = 100*(F-A)/E

ND = Not Detected, J = Present Below Reporting Limit, B = Present in Blank, NR = Not Requested, I = Interference, NA = Not Applicable
N = See Narrative, EQL = Estimated Quantitation Limit, NC = Non Calculable - Sample amount is > 4 times the amount spiked.

Sample Duplicate Recovery

Project Name: Waterline Replacement Kickerillo Area

Work Order #: 465370

Lab Batch #: 916783 **Project ID:** 1140194601
Date Analyzed: 06/21/2013 09:43 **Date Prepared:** 06/21/2013 **Analyst:** ANS
QC- Sample ID: 465370-001 D **Batch #:** 1 **Matrix:** Soil
Reporting Units: Ohm-cm

Soil Resistivity (As Received) by NACE	SAMPLE / SAMPLE DUPLICATE RECOVERY				
Analyte	Parent Sample Result [A]	Sample Duplicate Result [B]	RPD	Control Limits %RPD	Flag
Soil Resistivity	1480	1460	1	20	

Lab Batch #: 916718
Date Analyzed: 06/20/2013 14:52 **Date Prepared:** 06/20/2013 **Analyst:** DHE
QC- Sample ID: 465370-010 D **Batch #:** 1 **Matrix:** Soil
Reporting Units: SU

Soil pH by EPA 9045C	SAMPLE / SAMPLE DUPLICATE RECOVERY				
Analyte	Parent Sample Result [A]	Sample Duplicate Result [B]	RPD	Control Limits %RPD	Flag
pH	9.15	9.17	0	20	

Lab Batch #: 916718
Date Analyzed: 06/20/2013 14:52 **Date Prepared:** 06/20/2013 **Analyst:** DHE
QC- Sample ID: 465370-018 D **Batch #:** 1 **Matrix:** Soil
Reporting Units: SU

Soil pH by EPA 9045C	SAMPLE / SAMPLE DUPLICATE RECOVERY				
Analyte	Parent Sample Result [A]	Sample Duplicate Result [B]	RPD	Control Limits %RPD	Flag
pH	8.40	8.41	0	20	

Spike Relative Difference RPD 200 * | (B-A)/(B+A) |
All Results are based on MDL and validated for QC purposes.
BRL - Below Reporting Limit

ANALYSIS REQUEST & CHAIN OF CUSTODY RECORD

XENCO Laboratories

☑ 4143 Greenbriar Drive, Stafford, TX 77477 **281-240-4200**
☐ 5332, Blackberry Drive, San Antonio, TX 78238 **210-509-3334**
☐ 9701 Harry Hines Blvd., Dallas, TX 75220 **214-902-0300**
☐ 12600 West I-20 East, Odessa, TX 79765 **432-563-1800**

Serial #: 322260 Page 1 of 2

Company-City: GEOTEST ENGINEERING HOUSTON **Phone:** 713 2660588

Lab Only: 465370-H

Project Name-Location: Water Line Replacement Kickerillo Area ☐ Previously done at XENCO **Project ID:** 1140194601

TAT: ASAP 5h 12h 24h (48h) 3d 5d 7d 10d 21d Standard TAT is project specific.
It is typically 5-7 Working Days for level II and 10+ Working days for level III and IV data.

Proj. State (TX), AL, FL, GA, LA, MS, NC, NJ, PA, SC, TN, UT Other
Proj. Manager (PM): Mohan Ballagere

E-mail Results to ☐ PM and nkolli@geotesteng.com **Fax No:**

Invoice to ☑ Accounting ☐ Inc. Invoice with Final Report ☐ Invoice must have a P.O.
Bill to:

Quote/Pricing: **P.O. No:** ☐ Call for P.O.

Reg Program: UST DRY-CLEAN Land-Fill Waste-Disp NPDES DW **TRRP**
QAPP Per-Contract CLP AGCEE NAVY DOE DOD USACE OTHER:

Special DLs (GW DW QAPP MDLs **RLs** See Lab PM Included Call PM)

Sampler Name **Signature**

Analysis columns (printed): VOA: Full-List BTEX-MTBE EtOH Oxyg VOHs VOAs | VOA: PP TCL DW Appdx-1 Appdx-2 CALL Other: | PAHs SIM 8310 8270 | TX-1005 DRO GRO MA EPH MA VPH | SVOCs: Full-List DW BN&AE TCLP PP Appdx-2 CALL | OC Pesticides PCBs Herbicides OP Pesticides | Metals: RCRA-8 RCRA-4 Pb 13PP 23TAL Appdx 1 Appdx2 | SPLP - TCLP (Metals VOCs SVOCs Pest. Herb. PCBs) | EDB / DBCP | **TAT**ASAP 5h 12h 24h 48h 3d 5d 7d 10d 21d | Addn: PAH above mg/L W, mg/Kg S Highest Hit | Hold Samples (Surcharges will apply and are pre-approved) | Sample Clean-ups are pre-approved as needed | **Remarks** Addn: Date Rcv. by: From:

#	Sample ID	Sampling Date	Time	Depth ft' In" m	Matrix	Composite	Grab	# Containers	Container Size	Container Type	Preservatives	pH	Resistivity	Chloride and Sulphate
1	GB-2 S#5	5-6-13		8-10	S		/					/	/	/
2	GB-5 S#5	5-6-13		8-10	S		/					/	/	/
3	GB-6 S#4	5-6-13		6-8	S		/					/	/	/
4	GB-7 S#4	5-6-13		6-8	S		/					/	/	/
5	GB-9 S#4	5-7-13		6-8	S		/					/	/	/
6	GB-13 S#6B	5-7-13		10-12	S		/					/	/	/
7	GB-16 S#5	5-8-13		8-10	S		/					/	/	/
8	GB-17 S#7	5-8-13		12-14	S		/					/	/	/
9	GB-22 S#7	5-6-13		12-14	S		/					/	/	/
10	GB-24 S#6	5-6-13		10-12	S		/					/	/	/

Relinquished by (Initials and Sign)	Date & Time	Relinquished to (Initials and Sign)	Date & Time
1) C. Dash	6/20/13	2) [signature]	6-20-13 9:55
3) [signature]		4) [signature]	
5) [signature]	6-20-13 10:40	6) Tanya Harrington	6/20/13 @ 1040

Total Containers per COC: Cooler Temp: N/A °C

Otherwise agreed on writing. Reports are the Intellectual Property of XENCO until paid. Samples will be held 30 days after final report is e-mailed unless hereby requested. Rush Charges and Collection Fees are pre-approved if needed.

Preservatives: Various (**V**), HCl pH<2 (**H**), H2SO4 pH<2 (**S**), HNO3 pH<2 (**N**), Asbc Acid&NaOH (**A**), ZnAc&NaOH (**Z**), (Cool, <4C) (**C**), None (**NA**), See Label (**L**), Other (**O**)
Cont. Size: 4oz (**4**), 8oz (**8**), 32oz (**32**), 40ml VOA (**40**), 1L (**1**), 500ml (**5**), Tedlar Bag (**B**), Various (**V**), Other **Cont. Type:** Glass Amb (**A**), Glass Clear (**C**), Plastic (**P**), Various (**V**)
Matrix: Air (**A**), Product (**P**), Solid (**S**), Water (**W**), Liquid (**L**)

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ANALYSIS REQUEST & CHAIN OF CUSTODY RECORD

XENCO Laboratories

☐ 4143 Greenbriar Drive, Stafford, TX 77477 **281-240-4200**
☐ 5332, Blackberry Drive, San Antonio, TX 78238 **210-509-3334**
☐ 9701 Harry Hines Blvd., Dallas, TX 75220 **214-902-0300**
☐ 12600 West I-20 East, Odessa, TX 79765 **432-563-1800**

Serial #: 322261 Page 2 of 2

Lab Only: 465370-11

Company-City GEOTEST ENGINEERING HOUSTON	**Phone** 713 266 0568
Project Name-Location Waterline Replacement Kickerillo Area	☐ Previously done at XENCO **Project ID** 1140194601
Proj. State: TX, AL, FL, GA, LA, MS, NC, NJ, PA, SC, TN, UT Other	**Proj. Manager (PM)** Mohan Ballagere.
E-mail Results to ☐ PM and nkolli@geotesteng.com.	**Fax No:**
Invoice to ☑ Accounting ☐ Inc. Invoice with Final Report ☐ Invoice must have a P.O. Bill to:	
Quote/Pricing:	**P.O. No:** ☐ Call for P.O.
Reg Program: UST DRY-CLEAN Land-Fill Waste-Disp NPDES DW **TRRP** QAPP Per-Contract CLP AGCEE NAVY DOE DOD USACE OTHER:	
Special DLs (GW DW QAPP MDLs RLs See Lab PM Included Call PM)	
Sampler Name	**Signature**

TAT: ASAP 5h 12h 24h (48h) 3d 5d 7d 10d 21d Standard TAT is project specific.
It is typically 5-7 Working Days for level II and 10+ working days for level III and IV data.

	Sample ID	Sampling Date	Time	Depth ft' In" m	Matrix	Composite	Grab	# Containers	Container Size	Container Type	Preservatives
1	GB-34 S#4	5-6-13		6-8	S		/				
2	GB-38 S#6	5-8-13		8-10	S		/				
3	GB-41 S#6	5-8-13		10-12	S		/				
4	GB-42 S#6	5-8-13		10-12	S		/				
5	GB-43 S#7	5-8-13		10-12	S		/				
6	GB-46 S#5	5-7-13		8-10	S		/				
7	GB-48 S#7	5-7-13		12-14	S		/				
8	GB-50 S#4	5-7-13		6-8	S		/				
9											
10											

VOA: Full-List BTEX-MTBE EtOH Oxyg VOHs VOAs
VOA: PP TCL DW Appdx-1 Appdx-2 CALL Other:
PAHs SIM 8310 8270
TX-1005 DRO GRO MA EPH MA VPH
SVOCs: Full-List DW BN&AE TCLP PP Appdx-2 CALL
OC Pesticides PCBs Herbicides OP Pesticides
Metals: RCRA-8 RCRA-4 Pb 13PP 23TAL Appdx 1 Appdx2
SPLP - TCLP (Metals VOCs SVOCs Pest. Herb. PCBs)
EDB / DBCP
pH
soil resistivity
chloride and sulphate

TAT ASAP 5h 12h 24h 48h 3d 5d 7d 10d 21d
Addn: PAH above mg/L W, mg/Kg S Highest Hit
Hold Samples (Surcharges will apply and are pre-approved)

Remarks
Sample Clean-ups are pre-approved as needed
Addn: Date Rcv. by: From:

Relinquished by (Initials and Sign)	Date & Time	Relinquished to (Initials and Sign)	Date & Time
1)	6/20/13	2)	6.20.13 9:57
3)		4)	
5)	6.20.13 10:40	6)	6/21/13 10:40

Total Containers per COC: Cooler Temp: N/a °C

Otherwise agreed on writing. Reports are the Intellectual Property of XENCO until paid. Samples will be held 30 days after final report is e-mailed unless hereby requested. Rush Charges and Collection Fees are pre-approved if needed.

Preservatives: Various (**V**), HCl pH<2 (**H**), H2SO4 pH<2 (**S**), HNO3 pH<2 (**N**), Asbc Acid&NaOH (A), ZnAc&NaOH (**Z**), (Cool, <4C) (**C**), None (**NA**),See Label (**L**), Other (**O**) _____
Cont. Size: 4oz (**4**), 8oz (**8**), 32oz (**32**), 40ml VOA (**40**), 1L (**1**), 500ml (**5**), Tedlar Bag (**B**), Various (**V**), Other _____ **Cont. Type:** Glass Amb (**A**), Glass Clear (**C**), Plastic (**P**), Various (**V**)

Matrix: Air (**A**), Product (**P**), Solid (**S**), Water (**W**), Liquid (**L**)

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XENCO Laboratories

Prelogin/Nonconformance Report- Sample Log-In

Client: Geotest Engineering, Inc.

Date/ Time Received: 06/20/2013 10:40:00 AM

Work Order #: 465370

Acceptable Temperature Range: 0 - 6 degC
Air and Metal samples Acceptable Range: Ambient

Temperature Measuring device used :

Sample Receipt Checklist		Comments
#1 *Temperature of cooler(s)?	20	
#2 *Shipping container in good condition?	**Yes**	
#3 *Samples received on ice?	**No**	
#4 *Custody Seals intact on shipping container/ cooler?	**No**	
#5 Custody Seals intact on sample bottles?	**No**	
#6 *Custody Seals Signed and dated?	**No**	
#7 *Chain of Custody present?	**Yes**	
#8 Sample instructions complete on Chain of Custody?	**Yes**	
#9 Any missing/extra samples?	**No**	
#10 Chain of Custody signed when relinquished/ received?	**Yes**	
#11 Chain of Custody agrees with sample label(s)?	**Yes**	
#12 Container label(s) legible and intact?	**Yes**	
#13 Sample matrix/ properties agree with Chain of Custody?	**Yes**	
#14 Samples in proper container/ bottle?	**Yes**	
#15 Samples properly preserved?	**N/A**	
#16 Sample container(s) intact?	**Yes**	
#17 Sufficient sample amount for indicated test(s)?	**Yes**	
#18 All samples received within hold time?	**No**	Samples received past recommended 28 Day hold time
#19 Subcontract of sample(s)?	**N/A**	
#20 VOC samples have zero headspace (less than 1/4 inch bubble)?	**N/A**	
#21 <2 for all samples preserved with HNO3,HCL, H2SO4?	**N/A**	
#22 >10 for all samples preserved with NaAsO2+NaOH, ZnAc+NaOH?	**N/A**	

*** Must be completed for after-hours delivery of samples prior to placing in the refrigerator**

Analyst: TT	PH Device/Lot#:

Checklist completed by: Tanya Torres Date: 06/20/2013

Checklist reviewed by: Debbie Simmons Date: 06/20/2013